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ENGINEERING • INDUSTRY • SCIENCE • BUSINESS

JUNE 1947

PROGRESS IN METALWORKING — Report to Management . . 45

SPECIAL FEATURES

World Oil Center Moving . . . 6
Synthetic Fuel from Coal 8
Nylon from Corncobs 11
For Easy Handling 13
Pinpoint Avigation 16
Conveyorized Ore Plant 19
Better Textile Machinery 22
Technical Shorts 24
New Way to Make Soap 26
Cutting Coal Mining Costs . . 33
New Products 36
Cottonseed Oil Process 40

AVIATION

Oxygen Boosts Power 14
Magnesium Fires Aloft 34
What's New in Aircraft 43
Also: 10, 16, 17, 28, 36, 37, 38

CHEMISTRY

Speeds Film Developing 10
New Plastic Process 23
Aluminum-Silicon from Clay . . 42
Also: 6, 8, 11, 25, 26, 31, 36, 40

CONSTRUCTION

Construction Techniques 29
Cut Apartment Costs 32
Highway Techniques 44
Also: 8, 12, 14, 18, 22, 25, 34, 38

ELECTRICITY, POWER

New for the Home 17
TVA No Yardstick 27
Latest in Lighting 34
Also: 6, 10, 20, 24, 36, 38, 39

ELECTRONICS, RADIO

Sees Through Wall 12
Microwave Diathermy 14
Rate-of-Change Meter 15
Also: 24, 28, 30, 32, 37, 38, 39, 44

FACTORY METHODS

Stencils Simplify Control 15
System for Salesmen 19
Raises Foundry Output 44
Also: 13, 18, 20, 24, 32, 35, 36, 39

FOOD PROCESSING

Frozen Food Wax Coated 12
Package Progress 30
Food Outlook 41
Also: 11, 14, 24, 36, 37, 38, 39, 40

MECHANICAL DESIGN

Metal May Weaken Part 17
Hydraulic Coupling 27
Extends Use of Carbide 34
Also: 18, 19, 22, 27, 37, 38, 39, 43

METALWORKING

New Polishing Methods 18
Finds Inside Flaws 24
Speeds Pipe Making 27
Boosts Plating Output 35
Also: 17, 19, 24, 32, 34, 39, 42, 44

MINING

How to Reduce Dust 18
Coal Breaker Cuts Costs 28
Sinks Mine Shafts 35
Also: 8, 9, 17, 19, 23, 30, 33, 39

TEXTILES

Controls Hose Knitting 10
Shrinkproofing Progress 28
Electronic Warper Drive 30
Also: 15, 19, 22, 24, 25, 36, 37, 38

TRANSPORTATION

Vertical Car Park 9
Increases Bus Safety 27
Rail Remover 42
Also: 6, 12, 17, 21, 31, 32, 33, 43

170 ITEMS IN THIS ISSUE

International Review of New Developments

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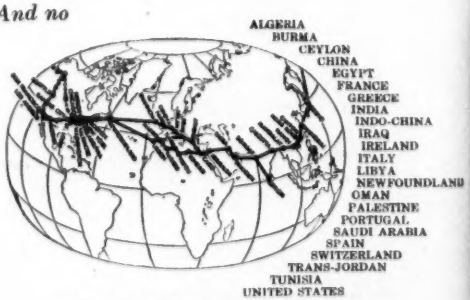

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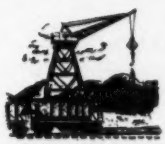

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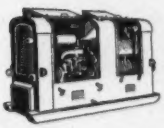

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World Oil Center Moving

Rapidly growing world oil markets and wartime depletion of U. S. reserves are factors. Long-range outlook presented; world reserves estimated

Changing conditions of supply and demand are moving the "center of gravity" of world oil from the Gulf of Mexico-Caribbean area to the Persian Gulf area. This shift is likely to continue until the center is established firmly in the eastern area.

Two reasons for this shift are apparent: (1) world oil markets are growing rapidly, and (2) the United States oil reserves, drained heavily during the war, must be conserved to meet domestic needs. Currently, the United States is a net oil exporter, eventually she must become a net importer. These import needs will probably be met by imports from Latin America.

At end of World War I, world petroleum demand was less than 525,000,000 bbl. per year, about two-thirds of the supply being consumed by United States. Between World Wars I and II, U. S. consumption increased so rapidly that by 1937 the U. S. was consuming 56% of the world's production of 2,250,000,000 bbl. By 1947 world production had reached 3,000,000,000 bbl.; the U. S. had increased its consumption and was consuming 58% of the total.

Outlook for Demand—Demand for petroleum in parts of the world other than the U. S. is anticipated to expand more rapidly than in the U. S. during the next 20 years. By 1965, demand for the world's estimated 4,122,200,000-bbl. production will be divided as follows: 44% for the U. S., 35% for Eastern Hemisphere, 21% for other areas. This represents a 1,150,000,000-bbl. production increase over 1946. Of this the U. S. will consume 395,000,000 bbl., the remainder of the world 775,000,000 bbl.

The slightly more than 4,000,000,000-bbl. production will mirror an increase in consumption in all petroleum products. Reasons: (1) Foreign coal production may not recover rapidly enough in next few years to regain its wartime position as a source of power. (2) Obsolete coal-burning marine and inland equipment may be replaced by the more efficient oil-burning equipment. (3) Oil for domestic heating is gaining popularity at the expense of coal in areas where coal is not plentiful. (4) U. S. production of heavy fuel oils will decline as an increasing proportion of crude is converted to higher priced petroleum products. Thus, the U. S. will rely more on outside production to supply the heavy oil. (5) With currently large merchant fleets expected to be retained, demand for bunker fuel will increase.

Breakdown of this demand into petroleum products is expected to be: motor fuel, 439,730,000 bbl.; kerosene, 93,355,000 bbl.; fuel oil, 709,045,000 bbl.

Between 1950 and 1956, Europe again will reach her prewar high demand level and will become the world's greatest consumer of petroleum products, using about 474,071,000 bbl. annually. (Russia and her satellite countries are not included in the European estimate due to insufficient figures. But Russian oil supplies are believed to be self-sufficient.) Second to Europe's demand will be the Western Hemisphere, the U. S. excluded, which will consume 467,830,000 bbl. in 1965. Other areas' consumption is estimated as follows for 1965: East and South Asia, 111,377,000 bbl.; Oceania, 81,971,000 bbl.; North Africa, 65,054,000 bbl.; South and East Africa, 28,850,000 bbl.; West Africa, 18,088,000 bbl.; and Near East, 27,112,000 bbl.

Consumption by the U. S. in 1965, as estimated by Senate Committee investigating petroleum resources, will be: motor fuel, 970,000,000 bbl.; kerosene,

83,950,000 bbl.; fuel oil, 761,025,000 bbl.; lubricants, 40,150,000 bbl.

World Oil Reserves—Petroleum reserve estimates are, at best, guesses. As stated, the Western Hemisphere and the Near East are the world's largest sources of fuel oil; Russia and the Netherlands East Indies rank second. Known reserves of Western Hemisphere are largest in the Gulf of Mexico-Caribbean area. U. S. reserves, as of January 1, 1947, were placed at 20,873,000,000 bbl., other Western Hemisphere reserves were placed at 9,359,000,000 bbl. Middle East reserves are quoted at 16,000,000,000 bbl. but actually are closer to 26,000,000,000 bbl. Geologists believe vast resources remain unlocated, as only a few hundred drillings have been made.

These reserves will not meet the future world demands. Unbalance between estimated demand and estimated reserves in 1965 means that new oil fields must be located if needs are to be met. Oil economists are confident that we will not "run out" of oil by 1965. The unbalance in supply and demand is true in all areas except Europe and the Middle East. There, reserves will be able to fulfill estimated demand.

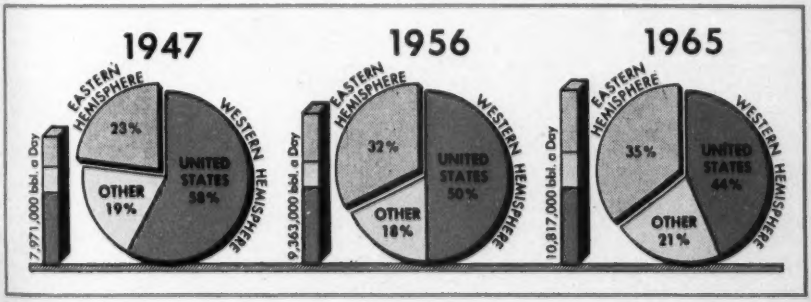
Petroleum geologists believe that vast unlocated petroleum reserves exist in the Western Hemisphere—in Venezuela and Colombia. The same is true of Iraq, Iran, and Saudi Arabia. Mexico, Peru, Canada, Kuwait, Quator, and Rumania probably have unlocated deposits.

Production Outlook—Between now and 1950, foreign crude production will surpass local demand. To use this surplus, Eastern Hemisphere consumption must rise tremendously. In 1939, that area produced 268,530,500 bbl.; by 1965 it will be producing 935,787,000 bbl., the Middle East-Persian Gulf area producing the bulk of the total. In comparison, the figures for the Western Hemisphere (U. S. not included) were 334,997,000 and 846,946,000 bbl. for the same years.

In 1938, the ten top petroleum producers were, in order of their production: Venezuela, Iran, the East Indies, Europe, Mexico, Iraq, Columbia, Trinidad, Argentina, and Peru. This alignment will shift by 1965 to Venezuela, Bahrein-Saudi Arabia, Columbia, Iran, East Indies, Persian Gulf area, Europe, Mexico, and India-Burma.

Crude production in the U. S. reached its peak last year when 1,730,100,000 bbl. were produced. This figure may rise about 1,000,000,000 bbl. by 1951, when annual production will level off at 1,642,500,000 to 1,715,500,000 bbl. This may mean that the U. S. will be importing about 300,000,000 bbl. of crude per year.

Lack of refining capacity in Eastern Hemisphere oil areas appears as a serious bottleneck to meeting the demand. Great damage was done to refining equipment during the war, and must be re-



Proportion of world oil requirements produced in U. S. will decrease in years ahead.

built. Extensive replacement and modernization also is necessary. Currently, Eastern Hemisphere refineries are producing too much fuel oil and too little gasoline and kerosene for current demand. Shifts necessarily will have to be made in production proportions.

In the U.S. it appears that refining capacity will keep pace with demand. Expansion during the war was extensive and the oil refineries are continuing to expand. —BUSINESS WEEK

Synthetic Fuel From Coal

Pilot plant hopeful of producing 2,400,000 cu. ft. of gas per day. Cost of synthetic fuel to be lower than previously expected, says U. S. Bureau of Mines

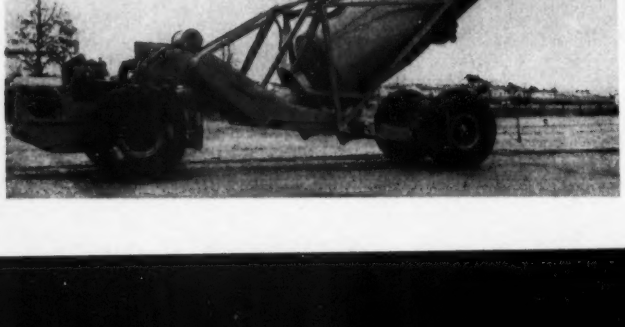
America's largest oil company—Standard Oil of New Jersey—and the largest coal company—Pittsburgh Consolidated Coal Co.—have entered into a cooperative research project to produce synthesis gas from coal. In pilot plant operation, officials hope to produce 2,400,000 cu. ft. of gas per day from 50 tons of coal. Synthesis gas consists of carbon monoxide and hydrogen, plus some carbon dioxide.

The pilot plant is to be built in Library, Pa., at a cost of $300,000. A wide variety of coal will be run through it to determine the best raw material available. This will be the determining factor in the final location of the large-scale plant. Estimates on the cost of such a synthetic-fuel plant are vague, but Consolidated officials believe that a commercial plant producing 400,000,000 cu. ft. of gas per day would cost in the neighborhood of $120,000,000.

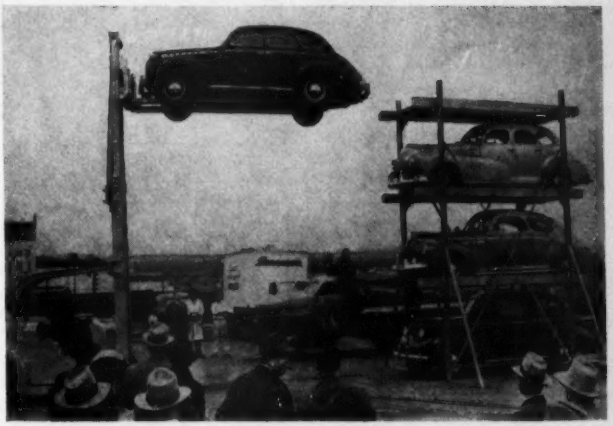
The Process—The fluidizing solids process subjects crushed coal, steam, and oxygen to 2000°F. in a generator. Powdered coal or coke is agitated into a cyclone, forming a carbon monoxide and hydrogen mixture. After the gas is manufactured, it can be converted into synthetic gasoline, diesel oil, ethyl alcohol, ketones, and other chemicals.

Standard Oil has used the fluidized solids methods with a catalyst in the reactor, but excessive heat is released. In fluid-type reaction less heat is generated, cooling rate is high.

Synthesis products are cooled in condensers, then liquids and gases are separated. Normal petroleum techniques are used to complete the production process with liquids. —BUSINESS WEEK



CONCRETE "HOWITZER" — Resembling a large-bore howitzer, this LeTourneau mobile, self-powered concrete mixer has a 7-yd. capacity. Mix is loaded at open end, then mixer is tilted up. When mixed, concrete is discharged through open end by reversing direction of mixing blades. It will pour into forms which are 20 ft. high. —ENGRG. NEWS-RECORD



VERTICAL CAR PARK—With a hydraulic lift truck and a 4-tiered parking rack, an attendant can stack an automobile on the fourth level in 2 min. Counterweights on lift compensate 100% for car weight. Fork lift fastens to knee action rather than to the axle. Parking system was developed by Sanders Brothers. —BUSINESS WEEK

Work by Bureau of Mines—Cost of producing synthetic fuels will be considerably lower than anticipated, studies by the Bureau of Mines indicate. Industrial estimates based on new research place the cost of making gasoline from coal or oil shale at 7½ to 9½¢ a gal. This is only a few cents higher than current cost of gasoline from petroleum, but does not include profit on investment.

In the hydrogenation gas-synthesis methods of converting coal to oil, lower pressures and lighter equipment will effect economies. Coal may be converted to distillable oil at relatively low pressures by employing special solvents and very active catalysts. Another radical departure from European practice is the discovery that coal may be hydrogenated in a dry or powder state, eliminating several costly and complicated steps.

In gas-synthesis process, heat removal has been a major European problem. A new chamber developed by the Bureau of Mines controls temperatures by evaporating a cooling oil over the catalyst. Production rates have been more than doubled, and the cooling method will permit enlarging the chamber to any size practicable for construction.

In Missouri, a demonstration plant is being built to produce 200 bbl. a day of oil or gasoline from coal.

An oil-shale laboratory in Wyoming has obtained oil recoveries greater than the assay value of the shale. It uses a thermal solution process which employs hot solvents to extract the oil.

Synthetic processes, however, will not replace production from natural crude to any large extent for years.—POWER

SUCCEEDS IN GASIFYING COAL IN MINE

Satisfactory progress has been made in gasifying coal in the mines of Alabama Power Co. No difficulty has been encountered in maintaining combustion. There are, in fact, strong indications that it is possible to shift position of flame along exposed coal underground.

Resistance from roof falls and other causes, however, have prevented sufficient air flow to intensify burning so as to produce gas of highest quality. To overcome this, oxygen has been used.

Operations have proved that synthesis gas can be made continuously and have shown that this gas may be produced by blowing gas and steam alternately into the burning mine. —POWER

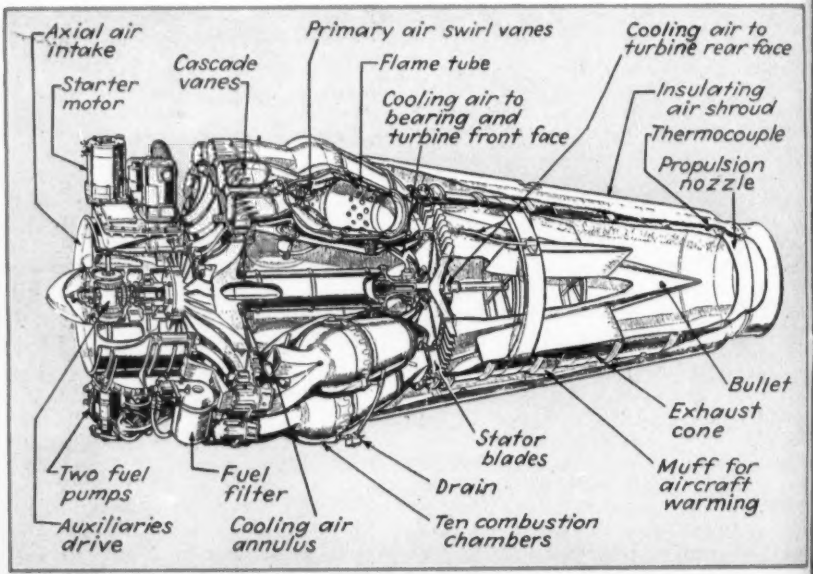
SPEEDS FILM DEVELOPING

New high-speed film developing machine, made by Eastman Kodak Co., processes movie film at 8 ft. per min. Machine requires darkroom conditions for operation but is light enough to mount in plane or car to develop news film enroute from scene. Thermostatically heated chemicals at 125°F. are used with film specially developed to withstand the heat.

Solution flows into three processing tanks through which film passes. Film is developed, rinsed, and fixed in 15 sec. After wash, film runs through rollers, squeezing out excess water, then it is dried over heated drums. The process is completed in 45 sec. compared with 40 min. normal time for developing the film. —BUSINESS WEEK

CONTROLS HOSE KNITTING

For making seam-free hose, Fidelity Machine Co.'s new 400-needle knitting machine is electronically controlled to provide smooth speed variation. The machine automatically introduces various yarns and changes speeds at various points in the cycle. Stop motions for yarn and needles give instant stopping without vibration. After starting, machine needs attention only for yarn supply. —TEXTILE WORLD



BRITISH IMPROVE TURBOJET—New deHavilland Ghost develops 5,000 lb. static sea level thrust, a gain of 2,000 lb. over Goblin predecessor with only 3-in. dia. increase. It is a centrifugal throughflow unit whose fuel consumption is only 1.06 lb./hr./lb. thrust. New features include turning vanes in diffusers; 10 (instead of 16) combustion chambers of larger dia.; divided ports in combustion chambers; and greater use of magnesium. Both impeller and turbine are mounted directly on large dia. main shaft, giving particularly rigid structure, better alignment for smoother running, and simplifying production and maintenance. Impeller is milled out of aluminum alloy forging and delivers 85 lb. of air per sec. at compression ratio of about 4.25:1. Turbine disk is of Jessop ferritic steel, with 97 Nimonic 80 nonferrous blades set in Christmas tree broached serrations and peened in place. Overall length, 10 ft. 2 in.; max. dia., 53 in.; dry weight, 2,011 lb.; max. speed, 10,000 rpm.—AVIATION

Nylon From Corncobs

In "perfect" chemurgic achievement, chemicals for nylon are produced from waste. Provides cheap material for expanding field of industrial processes

Considered the perfect example of chemurgy—chemical conversion of agricultural wastes into useful products—the synthesis of nylon from corncobs, oat hulls, cottonseed hulls, peanut shells, and similar materials has been achieved. This du Pont accomplishment will permit utilization of growable raw materials annually renewable in tremendous supply.

Furfural from the waste materials is used to make adiponitrile in a four-step process: (1) Furfural is converted into furan by removing CO from the side chain. This is a vapor-phase process whereby the furfural is carried with steam over a special zinc chromite catalyst at about 400°C. (2) Furan is readily hydrogenated over nickel or other catalysts to yield tetrahydrofuran. (3) Hydrochloric acid is reacted with tetrahydrofuran to give 1,4-dichlorobutane. At least three processes have been developed—two at atmospheric pressure and one at about 250 psi. In the first of the processes at atmospheric pressure, tetrahydrofuran and anhydrous HCl are blown into a dehydrating mixture containing zinc chloride or sulphuric acid. In the second atmospheric process, amine hydrochlorides may be used as catalysts. In the alternative process, aqueous hydrochloric acid is mixed with tetrahydrofuran and the reaction carried out in pressure-tight equipment at about 180°C. and 250 psi. (4) Dichlorobutane is reacted with sodium cyanide and the two Cl atoms are replaced by CN groups to yield the desired adiponitrile. This process is also carried out in the presence of a solvent which removes the adiponitrile from the NaCl and other reaction products. A final distallation yields ADN as a noncorrosive liquid of high purity.

Adiponitrile readily can be hydrogenated to produce hexamethylene diamine, or hydrolyzed to adipic acid. Thus both components of the historic Carothers' "66" synthesis of the nylon superpolymer of hexamethylenediammonium adipate could be made entirely from furfural.

It is not likely that the use of agricultural byproducts materially can reduce the cost of nylon within the near future. But the development has other interesting possibilities. Many new and valuable furan derivatives can be drawn off as side streams from the main synthesis. Also, the sodium cyanide method becomes an effective means of building up hydrocarbons to almost any desired number of carbon atoms, particularly in the important C_5 to C_8 range. Finally, furfural comes into its own as a comparatively cheap and pure raw material for an expanding field of industrial chemical processes. —CHEMICAL ENGRG.

NEW FOOD PRODUCTS

Hydrogenated shortening, fresh eggs, and milk have been processed together and spray-dried to produce Egganene. Packed in 150-lb. barrels by Northwest Egg Mix Co., the product is sold to blenders of cake, muffin, gingerbread, doughnut, and sweet dough mixes. A complete dry mix is produced by adding flour, sugar, salt, and leavening.

Bottled barbecue sauce, to be spooned over ham while baking, has been introduced by House of Herbs, Inc. It is a blend of tomato, meat broths, herb vinegars, Worcestershire sauce, fresh herbs and spices, salt, pepper, and benzoate of soda not exceeding 1/10%. The company has developed another sauce containing prepared mustard, seven fresh herbs, broth, sherry, spices, and sodium benzoate. —FOOD INDUSTRIES

FROZEN FOODS COATED WITH PROTECTIVE WAX FILM

Frozen foods now can be "packaged" by dipping in melted thermoplastic wax which hardens as a form-fitting and flexible wrapper. Developed by Utah Wax Refining Co., the new NoAir Wrap provides a "perfect" seal for frozen fish, meats, poultry, fruits, and vegetables. The wax does not stick to the food surfaces but does adhere closely to eliminate air pockets. It withstands ordinary rough handling at low temperatures, and meats coated with it have been held a year without evidence of "freezer burn" (desiccation) or discoloration. The coating can be stripped quickly and completely, coming off in large, cast segments after being broken with a knife.

Food may be dipped in the wax either before or after freezing. Several waxes can be used, and dipping temperatures usually range from 130 to 212° or more. A heated dipping tank for small operations holds 200 lb. of wax. From 500 to 1,000 lb. of meat can be dip-coated per hour. For high-volume operations, several types of continuous dipping machines have been developed. In one type, a conveyor carries the food through a tank of wax. The products then are conveyed by gravity through another compartment containing a solution which tempers the coating. Labels are placed with a low-temperature adhesive.—FOOD INDUSTRIES

IMPROVES CONCRETE PIPE

Use of two high-speed vibrators, operating at 7,000 vibrations per min., on each side of concrete-pipe forms permitted pouring of concrete with an average slump of 2½ in. and 1¼ in. max. aggregate in forms with a clearance of only 1½ in. Motors with 8,500 to 9,000 rpm. were mounted at about one-third the form height. Reinforcing wire was jig-placed from spools, longitudinal bars then being welded to cage and bell-and-spigot-joint rings attached to form ends. A small amount of grout was first sprayed over reinforcing wire, then concrete was poured by overhead crane. Distribution of concrete was controlled so as not to place concrete faster than vibrators could settle it.

Pipe sections are cured in a waterproof, plywood house for 72 hr. at 140°F. Fifty-two 16-ft. sections can be fabricated in 8-hr. —ENGRG. NEWS-RECORD

ELECTRONIC EYE SEES THROUGH BRICK WALL

Expected to have many practical applications, a microwave device developed by General Electric "sees" through solid objects. Resembling a large flashlight and operated on 110 volts ac., the 4-lb. unit comprises a "lighthouse" electronic tube, oscillating circuit, transformer, antenna, and reflector. It radiates a focused beam of high-frequency radio waves which pass through such objects as a brick wall but are reflected from dark or rough surfaces. A metal pipe will carry the beam in a circuitous path.

The radiated beam is received by a dipole antenna in a parabolic reflector. A silicon crystal detects the beam, and the resulting output can be indicated on a meter or used to operate a relay which in turn activates a bell or other device.

The unit can be used for such industrial tasks as counting, diverting, opening, closing, discarding, signaling, limiting, and projecting. And it will do these things through a nonmetallic wall or housing. —PRODUCT ENGRG.

TIRE POWDER STOPS STATIC

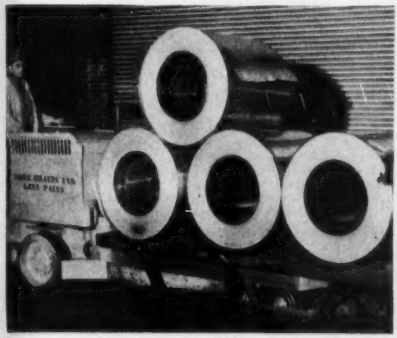
Powder that can be blown into automobile tire inner tubes to reduce static shock and car radio static has been perfected by U. S. Rubber Co. Clinging permanently to the walls of the tube, the powder modifies the electrical behavior of the tire and tube. It is the outgrowth of research in electrically conductive tires for industrial tracks and tractors in munitions plants. —ELECTRICAL WORLD

A 40,000-lb. load, including a train of seven 4-wheeled bin-skidloads of scrap plus a 5,000-lb. baled scrap load on lift, is towed 3,900 ft. from baler to remelt by this 5-ton, battery-powered, low-lift platform truck.

Easy Handling

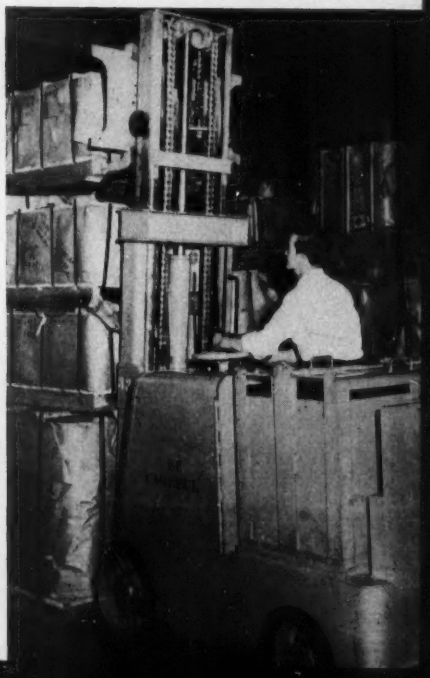
Aluminum Co. of America uses 111 battery-powered trucks to handle materials in Tennessee plant. —Factory

All movement in and out of storage is by fork-lift trucks, cases being strapped to fork-lift platforms. Maximum utilization of "vertical air rights" increases space.



Coil moving from conveyors is stacked on skids, then moved to annealing furnace. Skid loads weigh 12,000 lb., are easily moved by the 20,000-lb. capacity truck.

Box-skids are fitted with pockets into which fit the forks of this 4-ton, battery-powered, fork-lift truck. Aluminum scrap is dumped at baler by lift's rotating head.



These 250x320-ft. woven willow mattresses, weighted by 2 ft. of 50 to 250 lb. rocks, were sunk at river pier locations to prevent underwater scouring. Mattress, anchored upstream to barge, was evenly coated with rock, then cut loose.

OPEN-WELL DREDGING SINKS RIVER PIERS

Two midstream piers of a Mississippi River bridge at Memphis were sunk 100 ft. below low water level by open-well dredging. Water at 400 psi. was used to break sticky clay. Piers were floated to location, then sunk through willow mattress forced to bottom by weighting and used to prevent underwater scouring. Cutting edges of caisson were assembled on shore with fourteen 8-ft. watertight dredging wells inside. Concrete provided weight to sink caissons. Air pressure of 43 psi. was necessary 100 ft. below water level in order to keep the caissons watertight. —ENGRG. NEWS-RECORD

MICROWAVE DIATHERMY

Energy is radiated at 2,450,000 kc. by a new diathermy unit developed for the medical profession by Raytheon Mfg. Co. This frequency permits energy to be directed at patient like a beam of light, eliminating need for strapping electrodes. Another advantage claimed for the Microtherm is the absence of objectionable interference. —ELECTRICAL WORLD

LAYOUT BY LIGHT

Intricate castings are laid out and inspected with three-dimensional projection equipment developed by General Electric. Unskilled operators work to accuracy of 0.015 in. Method saves time and material. A layout drawing of part is photographed to microscopic accuracy on a glass slide. This image is projected by a lens directly onto surface of casting, the plane of true projection and correct dimensions being established by a plane-of-light projector at right angles to the first. System can be used to position layouts or intricate castings, to layout holes for flame-cutting or shearing, or to project a templet for machining. —AMERICAN MACHINIST

BETTER BUTTER WRAPPER

Shelf-life of fresh print butter is extended twice as long by a new foil wrapper as with other protective wrappers. Coated thin-gage aluminum foil is laminated to 15-lb. parchment paper to make the wrapper, which can be handled by a wrapping machine. Printed with colored ink, the foil is attractive. It reduces score and weight losses, and protects the butter against contaminating odors. Beatrice Foods adopted the new wrap after testing many materials, including plastics. —FOOD INDUSTRIES

OXYGEN BOOSTS PLANE POWER

At high altitudes, aircraft engine power can be boosted almost one-third by introducting liquid oxygen in supercharging system. Oxygen concentration is raised from normal 23.1% to 29%. Since this heats cylinders excessively, water injection is used along with it to produce internal cooling. Method is applicable only at altitudes at which supercharger cannot supply sufficient air to the engine. —AVIATION

RATE-OF-CHANGE METER WITH SHORT TIME LAG

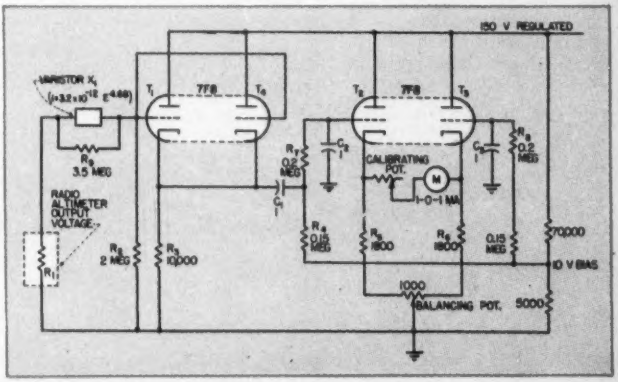
Variable resistance properties of certain materials such as thyrite can be used to straighten many nonlinear voltage characteristics. Thus the rate of change of a quantity represented by a nonlinear function of voltage can be obtained by conventional voltage differentiating circuits.

One application of these principles is a vertical velocity meter having smaller time lag than barometric rate-of-climb meters. Shown in the diagram, it is a novel combination of a varistor compensating network and a balanced double-triode stage.

The nonlinear radio altimeter output voltage across R_1 is impressed across a network consisting of varistor X_1, a parallel resistor R_2, and series resistor R_3. By virtue of its variable resistance characteristics, the varistor controls current flow in the network so that the resulting voltage across resistor R_3 is essentially proportional to altitude.

The voltage proportional to altitude is first reproduced across cathode resistor R_5 of cathode follower T_1, T_4. Differentiation then is performed by resistor-capacitor network C_1R_4; usable voltage appears across grid resistor R_4. Polarity of this voltage depends upon direction of the rate of change of altitude; the magnitude is a measure of the vertical velocity of the aircraft.

When rate of change is zero, voltage across R_5 of T_2 equals that across R_6 of T_3, and meter needle does not deflect. With change of altitude, deflection occurs, and is read on calibrated meter scale. —ELECTRONICS



Circuit of vertical-velocity, or rate-of-change, meter which shows rate of climb directly with short time lag. Basic principles have application wherever it is necessary to measure rate of change of a function represented by a nonlinear voltage.

STENCILS SIMPLIFY CONTROL

Production orders for stock parts usually involve transcription of operation data from master sheets. Transcription errors are easy to make and difficult to find. Most errors have been eliminated at Barrett-Cravens by putting all operation data for standard parts on 1¾x3½-in. addressograph stencil plates. Data shown include part number and name, sequence number of each operation, number of machine on which it is to be performed, operation name, standard hours allowed per 100 parts, and setup time allowed. As many as 16 operations have been listed, this being made possible by use of two-letter code for each operation.

The stencilled data for a part are reproduced on the four copies of the production order. —AMERICAN MACHINIST

Permits Pinpoint Avigation

New instrument continuously shows position and track of aircraft by intersection of two light beams controlled by radio compasses

Simple solution to many flight avigation problems, the new radio flight-position fixer gives pilot a continuous, easy-to-follow visual picture of craft's location. It was developed and proved by an Air Force officer and will be built by Sperry Gyroscope Co. for Army use. It is proposed as a new means of increasing air safety during bad weather and as a way to reduce over-airport stack-up time at destination. Primarily adapted to point-to-point avigation, the Radio Fixer can be used for low approaches in poor visibility.

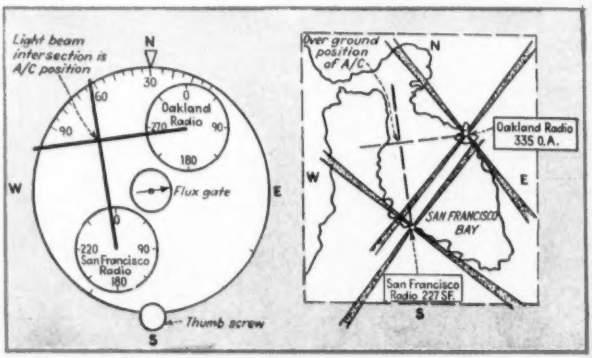
Principle of the Radio Fixer is simple triangulation. Each of two radio compass indicators is tuned to a different ground station. From center of each indicator, a beam of light is projected across translucent face of instrument at angle corresponding with plane's direction from station (diagram). Position of craft is point of intersection of the two beams. Since this visual indication moves exactly as does the plane, movement of the intersection represents the ground track being made. Direction of flight is shown by flux gate compass located in center of Fixer face between the radio compasses. The combination gives required azimuth stabilization. Since center of radio compass indicators are 3 in. apart on instrument, scale of miles-per-inch shown on instrument can be determined by measuring distance between stations on map.

Flight course to any selected destination may be marked on face of Fixer with a wax or flourescent pencil (at night). Even traffic patterns may be sketched readily. For aircraft flying regular courses, outline maps of desired areas or all airports along route may be prepared on extra translucent faces to be carried in cockpit and employed as needed. Obstructions, restricted areas, and other pertinent flight data may be shown. A course marked on Fixer face is held by keeping intersection of light beams moving along the course line.

Value of the device as an aid to blind approach and landings is seen in fact that any pilot can be instructed to hold over any area or to approach from any direction.

Including radio compasses (⅔ of weight) and other equipment, total weight of Fixer is 200 lb. Most commercial aircraft carry at least one radio compass. —AVIATION

Comparison between aircraft's position on aerial chart (right) and on face of simple radio position fixer.



FOR ROAD OR RAIL—Equipped with flanged steel pilot wheels hydraulically lowered and raised, Auto-Railer can run over highway or railroad tracks. Driving and braking are through special pneumatic tires. Full-revolving ¼-cu. yd. shovel is powered by 4-cyl. engine. Attachments permit quick conversion to trench hoe, crane, dragline, clamshell, orange peel, and pile driver. Evans Products Co. designed it. —ELECTRICAL WORLD

ADDING METAL TO PART MAY WEAKEN IT

Often the strength in a piece can be increased by removing instead of adding metal. Stresses in a hollow crankshaft were reduced by drilling out the crankpins farther than original design required, changing effective position of the stresses.

Accurate stress analysis revealed that some bolts in a gasoline engine were not stressed at all. They were doing nothing, and if tightened too tight they actually strained the parts. Bolts, bosses, and machining were eliminated, saving in a year more than cost of the stress analysis and new design.

Flight testing with strain gages revealed that crankshaft failures in an aircraft engine were caused by position of propeller relative to crankshaft. Maximum stresses were 80,000 psi. with steel propeller in one position, but 280,000 psi. when a position at right angles to first was reached. Using a wooden propeller introduced a stress of only 50,000 psi.

Stress engineer of Continental Motors Corp. uses brittle lacquer for stress analysis and electrical strain gages in operational tests —AMERICAN MACHINIST

FOR BRITISH LIGHTPLANES

Britain's Light Aeroplane Committee has outlined minimum requirements as well as general suggestions for future lightplane construction. All lightplanes should be low-wing monoplanes, with side-by-side seating and retractable landing gear. All-metal construction should be used in all but smallest planes. Minimum rate of climb should be 250 fpm., fully loaded, on one propeller, with landing gear down.

General recommendations were: all seats should be forward of the wing for better visibility; 48-in. minimum seat-by-seat width. —AVIATION NEWS

NEW FOR THE HOME

An ironer that can be folded away in a kitchen cabinet has been developed by Apex Electrical Mfg. Co. Ironer roll is 26 in. long, 6½ in. dia., and has knee and fingertip controls. Cabinet measures 36x18x25 in. . . Horizontal surging inward and outward from the center at a rate of 156 times per min. in the new ABC-O-Matic washer replaces standard vertical working action. Agitator vanes and central agitating column create centers of action in water. Washer accommodates 12-14 lb. load.

Landers, Frary, & Clark's new oven is equipped with recessed flood lights, push-button preheat, cutout, and temperature controls. Surface units are superheat, monotube thrift units with heat control. Well cooker has time and temperature control . . . Electric cords manufactured by Kellogg Switchboard & Supply Co. are self-retracting. —ELECTRICAL WEST

A self-contained battery powers the new LeJay Motors Corp. electric lawnmower. Battery charger for mower is built in. —ELECTRICAL MERCHANDISING

HOW TO REDUCE DUST IN HARD COAL MINING

Use of water in anthracite mining, on equipment and before blasting, is an effective way to keep down dust, thus increasing safety and improving efficiency of mine ventilation system. Accumulations of water in mines can be used, water being conducted to storage areas by pipe. At the face, pipe should be of 1-in. dia. with a 50-ft. length of ¾-in. hose and nozzle for application. Full-cone spray nozzle should deliver 5 gal. of water per min. at 45 lb. pressure. Tests show 3 gal of water per ton of coal effective in settling dust.

Excess dust in air can be determined by lamp test—light focused to narrow beam. If light is reflected on dust, contamination has reached danger point—50 million grains per cu. ft.

In drilling, hand operated drills produce little dust due to slow operating speeds. Compressed-air drills, creating much dust, now can be fitted with simple water attachments, forcing water through drill steel to bit as it operates. Full cone-spray mounted on return side of undercutter blade reduces dust and, by lowering cutter temperature, increases cutter life. Ribs, bottoms, and faces around blasting area should be dampened before blasting. —COAL AGE

NEW POLISHING METHODS

Two new techniques for electrolytic polishing of metal, developed at Frankford Arsenal, are faster, require less skill, and avoid "worked" layers in polished surfaces. One involves the use of a portable brush electrode for polishing individual areas of cumbersome objects. The electrode has a 12-volt dc. metallic cathode enveloped in a solution-retentive dielectric material. It is pressed gently against object to be polished.

The other technique is electrolytic "lapping," for metallographic specimens. It utilizes a stationary disk similar in construction to the brush electrode. Object to be polished is made the anode and is moved over the disk, moistened with electrolyte. —PRODUCT ENGRG.

PRECAST FLOORS FOR U.N.

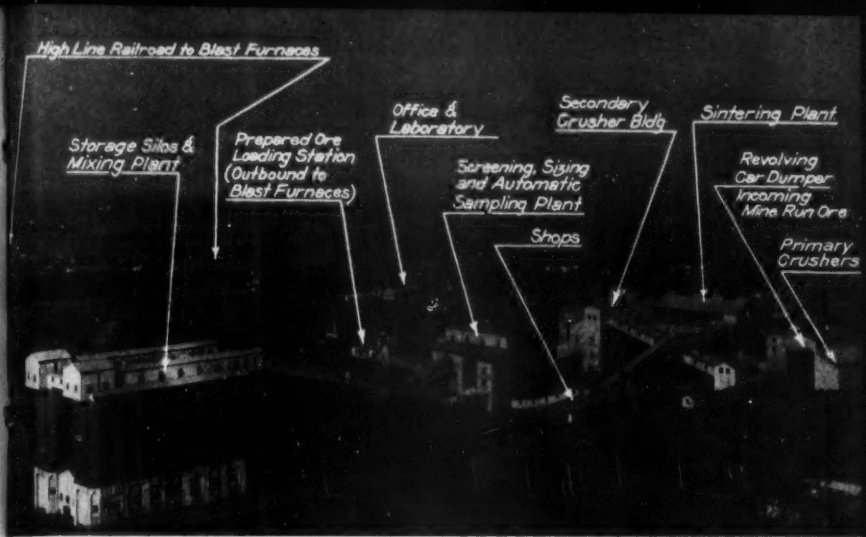
Floors and ceilings of 110 two- and three-story apartments being built for United Nations personnel will be integral precast concrete slabs cast into concrete forms. Excess water is drawn off by vacuum. Slabs vary from 17x10 ft. to 16x16 ft., are 1½ in. thick, and have passed 300 psi. load tests. Mix used is 6 bags of high early-strength cement per cu. yd.

Cores are blocked up high so that a heavy integral concrete base is provided when centers are concreted. Air is used to loosen form from mold. Preassembled, welded reinforcing and central-mix concrete is used. After concrete is placed, vacuum mats are placed to pull out excess water, permitting immediate finishing. Vacuum mats lift cast from mold when set. —ENGRG. NEWS-RECORD

MANAGEMENT AND BABIES

As part of its employee relations program, Sonoco Products Co. opens a savings account for each baby born to an employee. Employee is given a certificate by the company's president, then receives a bank book listing the company's initial deposit. Withdrawals cannot be made without signature of both parents until child is 15 yr. old.

To decrease absenteeism and to increase production through elimination of worry over children at home, John Swisher & Sons Cigar Co. has installed a nursery on the roof of its Florida factory. Employees may leave children there through work shift or for 24-hour periods. Staff includes a doctor, a trained nurse, 18 nursery-school-trained workers, 3 maids, and a janitor. Doctor checks children twice a week, gives each a complete physical once a month. Cost is $3 a week. —FACTORY



Remote controls and conveyorized handling contribute to efficiency in big central plant which prepares iron ores by crushing, screening, and blending. Sintering plant is believed to be the world's largest one.

Conveyorized Ore Plant

In large central operation, iron ores from several mines are classified, conditioned, and blended. Belt conveyors and remote control are heart of operation

To improve blast furnace practice, Tennessee Coal, Iron & Railroad Co. operates a big central plant for crushing, screening, and blending ores from all of its mines in the Birmingham district. Raw ore from the various mines is handled in scheduled sequence. A two-car rotary dump feeds the primary crushers, and when operator is ready to unload ore, he telephones ahead to various stations. When the silo control room receives the "all-clear" signal, the operator signals the rotary dump that everything is ready for handling ore from the specified mine.

Two 42-in. gyratories into which ore is dumped deliver to 36-in. conveyors which raise the material to surge bins. From these, the ore is fed by vibrating feeders into cone crushers set for 1½-in. max. size. Material passing crushers is collected on 42-in. belt, weighed on a conveyor scale, and taken to the screening plant for separation into coarse, medium, and fine grades.

Separation—Six double-deck vibrating screens separate the crushed ore into three sizes. Two double sets of 30-in. conveyors deliver either coarse or medium ore to 36-in. conveyors. After passing weigh stations that record by remote control at the silo room, these conveyors raise the ore to the 800-ton silos selected by the practice man. A series of 30-in. conveyors takes all fines over a scale, which also records at the silo-control room, to a group of twenty-three 350-ton bins adjoining the sintering plant.

Blending—Each bank of 20 silos has a separate proportional feeder for each four silos, so arranged that it can draw

from only one silo at a time. Each of the fines bins has a separate feeding scale underneath, and material from it may be blended in any combination or weight.

Assembly of five different ores is done by blending plant operator. Under each silo is an air-operated gate which discharges into a hopper common to a group of four silos. Under the hopper is a vibrating feeder, electrically controlled from a 60-in. weigh belt. By varying belt speed, its discharge rate may be changed from 1 ton to 10 tons per min. Thus five belts feed from the coarse-ore silos to the main blend belt, and a similar setup is installed under the medium-ore silos, both sets of feeder belts discharging to their own 36-in. blending belts. In silo-control room, operator takes practice man's sheets, opens correct silo gates, starts the weigh belts, and sets the individual indicator dials to prescribed feeding rate.

Sintering — The iron-ore sintering plant, thought to be the largest in the world, adjoins the crushing plant and is equipped with three sintering machines and three rows of bins for stacking ore fines, flue dust, and coke breeze. Flue dust and coke screenings arrive in drop-bottom cars and unload into a track hopper which acts as a surge bin. From this, sliding gates deliver onto a 36-in. belt which discharges over a tripper into either of two short rows of bins.

Ore fines are brought to the sintering plant bins on a series of 30-in. belts which pass over a conveyor scale that records at silo-control room so that weight of three fractions into which raw ore is divided can be totaled. A tripper discharges the fines, by mine runs, into appropriate bins, as with the coarse and medium fractions.

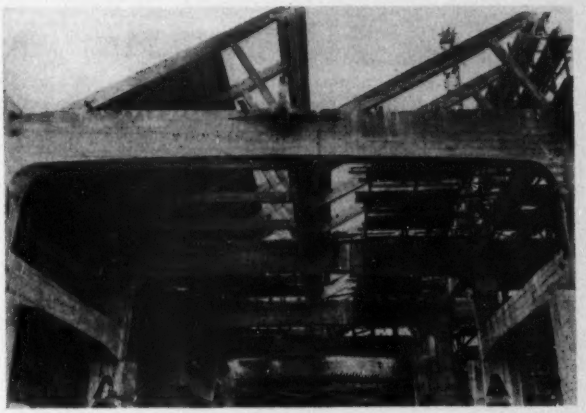
Preparing Mix — Material is blended by sintering-machine operators under instructions from practice man. Scale feeders under each fines bin draw fines from fixed notches, using a vibrator to assure constant flow. The belts discharge onto a conveyor which also picks up correct amount of flue dust or coke breeze enroute to hopper above pugmill feeding sintering machines. Sinter fines are added to the fine-ore and flue-dust blend on the belt. From bin at end of conveyor, blended fines are fed into a pugmill for each sintering machine; moisture may be added. —ENGRG. & MINING JOURNAL

PLASTIC PROTECTS DRY CELLS

Shelf life of dry batteries can be extended to 6 months, even at 130°F., if they are given a 1-mm. coating of a vinyl-resin plastic. National Bureau of Standards has found this protection far superior to storage in glass, can, or metal-lined bags. Permeability of the plastic coating permits escape of hydrogen evolved by the cells and "breathing" access of air and water vapor. Batteries sealed in glass build up pressures sufficient to cause explosion.

Drying-out and possibly the action by atmospheric oxygen are primary causes of battery deterioration at elevated temperatures. —ELECTRICAL WORLD

FOR SECOND-STORY WORK—Scrap steel, a farm tractor, and a standard 26-ft. conveyor enables O. M. Scott Co. to deliver bagged seed direct to its second-story warehouse. Front end of conveyor rises 24 ft. above the ground. Conveyor is raised by a standard Ferguson hydraulic scraper lift. —BUSINESS WEEK



CONCRETE FRAME — In Sao Paulo, Brazil, factory of General Electric, concrete frame was used throughout. In 6 transverse bays 66 ft. long and 7 longitudinal bays 33 ft. long, bents are twin-legged below crane-rail level. Main girder is 19¾ in. wide, 80 in. deep at haunches, 71 in. at center. Saw-tooth roof frame is also concrete, vertical members inclined 60 deg. away from face. Roof will be precast concrete slabs with corrugated asbestos covering. — ENGINEERING NEWS-RECORD

HYDERABAD, INDIA, PLANS VAST INDUSTRIAL GROWTH

To cover 20 yrs., the vast industrial expansion program of the Princely State of Hyderabad, India, will cost approximately $11,000,000,000 and include both private and state industries. Comprising 45% of India's wealth and population, the state is the heart of the country's industry. Hydroelectric expansion, modeled after the U. S. TVA project, will embrace power irrigation and fertilizer output.

A 37,500-kw. steam electric plant and a 15,000-kw. hydro plant are under construction at Ramgundam and Nizamsagar. At Kalvalgurda, a 60,000-kw. station with a 100,000-kw. flood-season capacity will be built. The Godaveri-Indravati river junction dam will supply 150,000 to 250,000-kw.

Output of the state's sugar factory at Bodhan will be raised from 1,400 to 4,000 tons per day this year. Industrial alcohol will be produced at a rate of 3,000 gal. per day from waste molasses. Bus bodies and 20,000 refrigerators per year will come from a Hyderabad city furniture manufacturer. A bicycle and motor cycle manufacturer has taken over a war-built Bren gun factory. Other plants planned will include: a 2,000-ton-per-month asbestos plant, a 50-ton-per-day glass plant, a 30-ton-per-day glass plant, a 10-ton-per-day sulphuric acid plant, a machine-tool plant, and six cotton textile mills, containing 2,500 looms and 121,000 spindles. Still needed are 10 cotton textile mills, chemical plants, and a telephone system. —BUSINESS WEEK

INTERNATIONAL BUS LINE

A. B. Linje Buss, Sweden, is now operating international routes between Halsingborg, Sweden, and Paris, Prague, and Basel in the first European international bus service. Two types of buses are used. A 20-passenger, diesel-powered, intercity bus is equipped with skyview roof and buffet. Skyview panels slide back, allowing passengers to sit on the roof during more scenic portions of the trip. A 30-passenger semitrailer bus has arm chairs, radio, and pantry. Crews consist of driver, his relief, and one or two hostesses.

All buses tow a trailer for extra fuel and food. Fare includes all meals and lodging enroute. The 850-mile Paris run costs about $67, takes four days. Passengers are not discharged between the two terminals. —BUS TRANSPORTATION

For Better Textile Machines

Designers turn to aluminum to reduce weight, improve quality. Ease in fabrication, resistance to corrosion important. Industry large user of metal

Swinging away from the standard heavy textile machinery, designers are leaning more and more on aluminum for parts. Ease in fabrication, machining, assembly, and surface treatment; resistance to corrosion; and high strength and light weight attract designers to the metal as a means of overcoming the inefficiencies in old machinery. Its uses now range from the smallest bobbins to structural members of the mill itself. The textile industry has become the third largest user of the metal in the United States.

Aluminum rolls on cards reduce weight, give greater operating efficiency, and ease handling of rolls for cleaning and stripping. Alloys are used for grids, dividing rollers, side covers, and cast brackets on cards.

Excessive weight of old machinery in doubling, twisting, and winding operations greatly decreases efficiency. Die-cast aluminum separator blades now are used, so are aluminum-tube spindle drive barrels. Twister rollers, clearer rollers, traverse bars, ring holders, flyer blocks, and extruded ring rails and supports are now made of the light metal.

Bobbin holders and adapter brackets, now made of cast iron, soon will be made of die-cast aluminum. Moving parts of beams and warping, slashing, and sizing machinery will be made of it to increase speeds and lower maintenance costs. Fabricated and extruded parts for coning and spooling equipment and warpers will permit higher speeds.

Nonstaining quality of the metal will be an advantage in producing first-class warp. New, stronger yarns and developments in high-speed warping equipment require beams with higher strength, greater precision, better balance. Aluminum will meet these requirements.

Reduction in weight of loom parts will present a triple saving to management through lower power costs, less mechanical vibration, and greater motion uniformity. It will be used in lay beams, hand rails, and swords. Aluminum-alloy cast shuttle boxes, hand wheels, brackets, pulleys, and filling stop motions will replace ones of steel; aluminum heddle frames, reeds, harness mechanisms, and pickers are being developed. Nonmagnetic qualities of the metal will enhance its value in automatic looms.

Aluminum's resistance to acid atmospheres and solutions makes it especially useful in wet-process equipment. Neutral and slightly acid dyes have no effect on the metal. High heat retention factor and smooth finish of aluminum makes it valuable in finishing operations, such as dyeing, stretching on profile shapers, steaming, setting, and drying.

In textile mill construction, management finds the metal of value, especially for fume exhaust. —TEXTILE WORLD

AUTOMATIC BLOCK MAKER

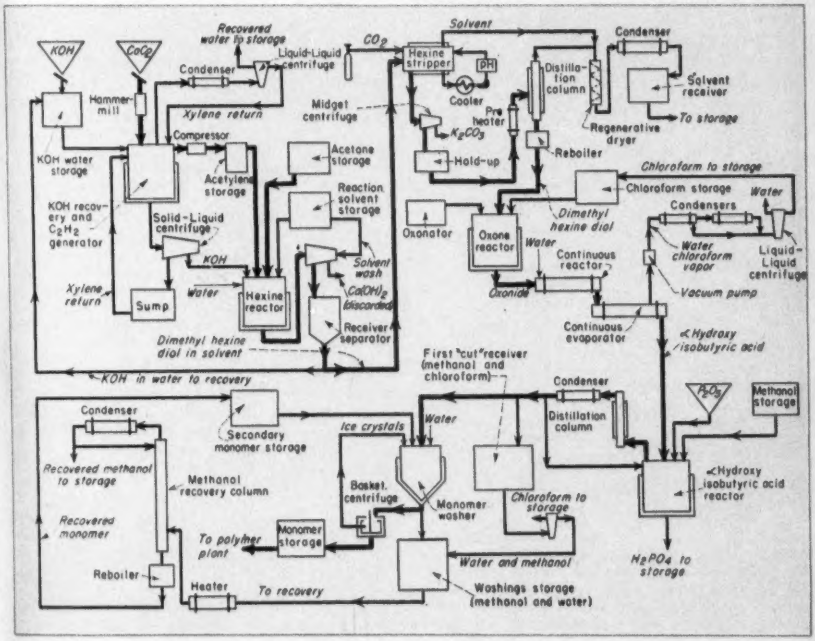
Twenty concrete blocks per min. are made by a new automatic, air-hydraulically operated, electrically controlled machine built by Henry & Hutchinson, Inc. It consists of a rotary table mounting five mold boxes, each with two 8x8x16-in. block molds. Four operations are performed successively at four stations. Station 1 has a hopper, charger, and vibrator. At station 2 block is compressed and formed to size by two air cylinders. At station 3, blocks are stripped from mold by a hydraulic cylinder. At station 4, pallets are replaced in mold box. Blocks of varying densities can be produced. Forming pressure is variable from 0 to 12,000 psi., and vibration time can be regulated. —PRODUCT ENGRG.

GREASE TRUCK SAVES TIME AND EQUIPMENT IN MINE

A mine-built grease truck is saving production time, reducing labor costs, and improving maintenance and safety at Simpson Creek Collieries Co. mine. Two men operate the self-propelled, trolley-and-cable-reel truck. A 7½-hp. motor drives it, and a 3-hp. motor powers the air compressor for greasing equipment. Wheel base is 42 in., truck gage is the same. Overall dimensions: length, 13 ft.; width, 6 ft.; height above rail, 37 in.

Three grease hoses, meters, and 6 barrels of lubricant are housed in the front end of the truck, covered by a hinged lid. Greasing crew works the 12:50 to 8 a.m. shift, servicing 14 loaders and cutters, also refilling shuttle-car section cans. A loading machine can be greased completely in 10 min. with the truck.

High pressure insures lubricant in tight fittings or bearings; lubricants are kept free from contamination; reduced spillage saves money and reduces fire hazard. —COAL AGE

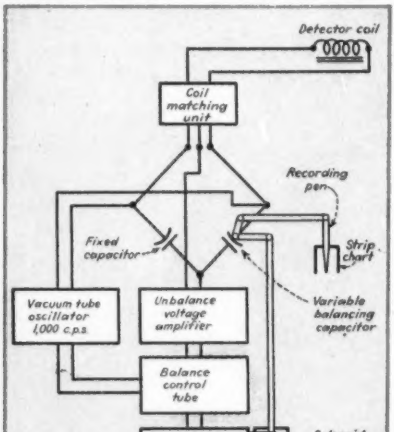


NEW PLASTIC PROCESS—Originally developed for Chinese government, Brothman process for producing methyl methacrylate (transparent plastic) resins is based upon new techniques and new reactions. Estimated plant-scale production costs are low, product quality is good, and monomer process can be switched readily to produce valuable intermediates and chemicals such as methyl butinol, methyl isobutanolone, and methacrylatone, as well as salts and esters of alpha-hydroxy isobutyric acid. Monomer synthesis consists of three steps: (1) synthesis of dimethyl hexine diol from acetylene, acetylene derivatives, and acetone; (2) an ozone catalyzed oxidation—splitting of the dimethyl hexine diol to alpha-hydroxy isobutyric acid, and (3) esterification and dehydration of alpha-hydroxy isobutyric acid with phosphorous pentoxide and methanol to form methyl methacrylate. —CHEMICAL ENGRG.

TECHNICAL SHORTS

Packard Cuts Cost—By shot-peening connecting rods and rocker arms on marine engines instead of polishing them, Packard saved 42 man hours per engine and increased fatigue life. —AMERICAN MACHINIST

Quick Transformer Test—In determining condition of insulation in power transformers by dielectric absorption test, the resistance rise between 30 and 60 sec. is more indicative than prolonged tests or inferences based upon slope ratios. The 1-min. test, using a motor-driven insulation testing set, is economical as well as efficient. —ELECTRICAL WORLD



FINDS INSIDE FLAWS—Cracks and other flaws in or near the interior surface of hollow parts such as cylinders or large tubes are located by a new detector which measures magnetic leakage caused by flaws. The detecting coil is connected to a bridge circuit and balanced by an identical coil. Extensions on highly permeable core of coil provide magnetic contact with the part. When the detector coil encounters a flaw, where the magnetic flux density is greater, the bridge circuit is unbalanced. This operates a milliammeter or, through an amplifier, a solenoid which actuates a recording pen or neon flasher. Before inspection, part is magnetized by direct current. Flat parts may be inspected. —PRODUCT ENGRG.

High-speed Roofing—Asphalt is pumped directly to roof and gunned on under 35-lb. air pressure by unique method developed by Acorn Protective Maintenance Co. Equipment used consists of tractor, air compressor, and a 1,200-gal. asphalt tank with four compartments equipped with agitators developing 750-lb. pressure. —CONSTRUCTION METHODS

Improves Dried Eggs—Added to whole egg before spray drying, carbohydrates exert a protective effect during drying and retard deterioration in storage. Addition of 20% sucrose is preferred for dried egg to be used in sponge cake, because it preserves foaming power. For general use, 10% lactose is preferred, except in scrambled eggs, where it is too sweet. —FOOD INDUSTRIES

To Eliminate Fiber Fly—To eliminate formation of chokes between card housing and sides of cylinder and doffer when working with metallic cloth, no unclothed areas should be left at either end of the doffer or cylinder. Fiber fly will thus be eliminated, according to Columbus Mfg. Co. —TEXTILE WORLD

Start 800-hp. Motor on 750-kw.—Capacitors solved the problem of starting an 800-hp. across-the-line induction motor on 750-kw. supplied by diesel-driven generators. Cost was only 10% that for hydraulic or magnetic couplings. With 2,295 rkva., the motor pulled into step in 18 sec. To aid generators under full-load, 180 rkva. was put on a circuit breaker which could be left in line. Other capacitors were on breaker that opened at proper time. —ELECTRICAL WORLD

Fast Dielectric Gluing—In fabricating edge-glued wood panels, and cores for furniture, dielectric heating is both inexpensive and fast because only the glue, not the wood, is heated. With glue and board parallel, the higher dielectric loss of the glue causes it to absorb most of the h-f power. With 5 kw. of heating-power and 250 psi. in edgewise pressure holding the boards, the glue sets enough in 30 sec. for the panel to be run through a planer. —ELECTRONICS

Miller Doubles as Lathe—Multiple-V pulley blanks, turned to size, bored, and with keyway cut, are mounted on special arbor in a milling machine. Carbide-tipped rough and finish tools are ganged up in machine vises on the table at either side, roughing tools being inverted. Table is moved left for rough cut, then right for finish. Cutting speed is 210 sfpm. at feed of ⅝ ipm. and chip load of 0.010 in. —AMERICAN MACHINIST

Cleans Wool Thoroughly—By means of draw and extender rolls, B. F. Perkins & Son wool conditioner removes burrs, chives, motes, and other foreign matter by tension rather than crushing action. Three sets of draw rolls reduce wool to gossamer-like web. First set of extender rolls, operating perpendicular to fiber length, breaks foreign matter; second set operates parallel to fiber length. Rolls are of special alloy steels, ground to exact tolerances. Machines can be used on any cloth fiber. —TEXTILE WORLD

Lights Support Ceiling—Formerly installed after architects and decorators had completed their designs, illumination now is an integrated component of creative planning. In a new appliance store, for example, a Celotex furred ceiling is suspended from hangers designed to support both fluorescent troffer units and ceiling. —ELECTRICAL CONST. & MAINT.

Germans Press Cold Steel—Steel cartridge cases, aircraft parts, and fuze bases were pressed cold in Germany during the war. Pressures up to 115 tons per sq. in. forced the metal to flow in the die, friction being cut by bonderizing the material. Process might be applicable in making wire, pipe, and stampings. —AMERICAN MACHINIST

Bridge Construction Aid—Four men can handle the 50-ft. aluminum alloy screed developed for work on highway bridge spans by contractors Lewis & Bowman. Consisting of I-beams and truss diagonal members, the screed is in 10-ft. sections for ease in transporting. —CONSTRUCTION METHODS

Electronic Filter—An electronic Filter with narrow bandpass characteristics can be made by using the R-C parallel-T network in a feedback amplifier. With component values differing from those producing the usual null characteristics, bandpass characteristics are more desirable for many applications than those produced by L-C filter. —ELECTRONICS

Increases Nylon Yarn Sizing—Two ¼-lb. nylon packages are built simultaneously at a spindle rate of 1,250 rpm. on standard bobbins in a new system of nylon yarn sizing developed by E.I. du Pont de Nemours. Traverse cam has 2¼-in. throw; guides are mounted 3⅜ in. apart. Tensions are mounted at converging angles, supply threads being ½ in. apart below size roll. Dividers are used to control ballooning of threads. —TEXTILE WORLD

Fast Flame Bending—Production has been increased over 200% in dragline-bucket manufacture by use of oxy-acetylene flame for bending and welding. Closer tolerances are obtained by flame bending than by blacksmith forge method. In 15 min. two men with torches heat 1¼ in. thick front lip of steel dragline bucket preparatory to bending to shape by a chain jack. —WELDING ENGINEER

FLOATING CHEMICAL COVER—Floating on chrome plating solution, 3-in. lengths of Styron prevent loss of chromic acid and protect workmen from dangerous fumes. The plastic tubes are closed at both ends and are not affected by acid. As object to be plated is lowered into solution, pieces spread, then close. —BUSINESS WEEK

Toasted Brake Linings—If brake linings are toasted to boil out volatiles for about half thickness and to char surface, "wearing-in" is eliminated and braking doubled on first application. Truck and bus operators are considering the idea, anticipating reduction of drum fouling, jerky applications, and noisy brakes. —AMERICAN MACHINIST

Heated Street—Residents of Belmont, Mass., a Boston suburb, have laid two 1½-in. dia. pipes in each wheel track of a steep black-top road to melt snow and ice in winter. Pipes are 5 in. below surface. Water is heated by roadside oil burner. —ENGRG. NEWS-RECORD

Pictures Replace Dresses—A New York City dress designer is replacing cumbersome dress displays with colored slide pictures. Display kit weighs 12 lb., containing projector, screen, and about 150 Kadachrome slides of dresses in full color. —BUSINESS WEEK

Seals Porous Castings—To make them water- and pressure-tight, castings showing microporosity are impregnated with thermosetting polyester resin, a vacuum being utilized in this operation. —AMERICAN MACHINIST

New Way To Make Soap

Continuous process reduces to hours an operation formerly requiring many days. It saves plant space, recovers more glycerin, improves product

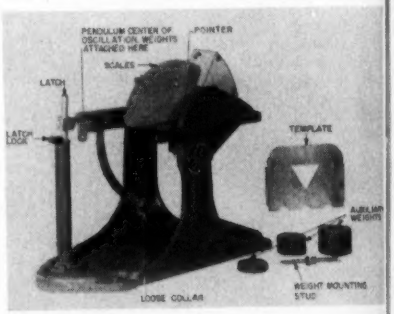
Chemical engineers have made the centuries-old soap kettle obsolete. Soap is now produced, from raw material to finished product, in hours instead of the many days formerly required. As developed by Procter & Gamble, the process is continuous countercurrent hydrolysis under pressure and at high temperature, with a catalyst, followed by continuous distillation, neutralization, and finishing.

Advantages—Largest single dollar advantage is the improved color of soap resulting from a crude fat, or ability to produce a desired color of soap from a darker crude fat without expensive pretreatment. Improved glycerin recovery also is a significant advantage, and flexibility in control of chemical and physical properties of the finished soap offers further dividends. Space requirements for the plant are much smaller, and manpower is less. The operations are more flexible, and much less raw material is tied up at any one time.

The Process—Raw fats and oils in proper proportion are pumped from storage tank to a blend tank equipped with preheating steam coils and a propeller-type mixer for stirring in the dry catalyst, zinc oxide. The fat mixture is kept at 220°F. in a feed tank, and water is held at 200°F. Fat mixture and water are put under high pressure by variable-speed triplex piston feed pumps. Injection of 900-lb. steam heats water to 480°F., the fats to 495°F., before entering 65-ft. hydrolyzer column at 600 psi. Fats are pumped into column near bottom and water near top for countercurrent flow. To make reaction proceed in right direction, glycerin is removed, as formed, by washing action of water.

Fatty material passes upward through the column in about 90 min., in which time splitting of fat into fatty acid is about 99% complete. The fatty acid discharges through an orifice into a flash tank. Dissolved water vaporizes, cooling the acids and blanketing them with steam—which protects them from darkening by exposure to air. Reducing the pressure on the glycerin solution as it comes out of the bottom of the column into a flash tank accomplishes first concentration in a multiple-effect evaporation.

Fatty acid collects in a feed tank and is pumped through a heat exchanger into a vacuum still. Distillation is at an absolute pressure of 2 to 5 mm. of mercury, and still bottoms are recirculated. Distilled fatty acid is condensed, cooled to about 180°F., then neutralized with caustic soda in a high-speed mixer. Salt is added to the caustic soda to secure "neat



TESTS CONTAINERS—Serviceability of paper and paperboard containers is determined closely with a new puncture tester developed by General Electric. It consists of a pendulum with a projecting arm which punctures the specimen, a pointer and appropriate scales for measuring the angle of pendulum swing, and a clamp to hold the test material. Released from horizontal position, the pendulum swings through an arc whose angle is proportional to puncture resistance. A collar on the curved pendulum arm holds open the triangular flaps torn in the material, avoiding error due to rubbing. Auxiliary pendulum weights are used in testing heavy materials. For paper, pendulum is released from 45-deg. elevation. —FOOD INDUSTRIES

soap" having the customary properties.

Soap from neutralizer is discharged at 200°F. into a blending tank with a vertical mixing worm. Conventional soap finishing may follow.

In general, equipment throughout the continuous process is of stainless steel where fatty acids are at high pressure or temperature, but of aluminum where at low pressure. —CHEMICAL ENGRG.

INCREASES BUS SAFETY

For added safety on its buses, B&W Lines has installed an electrical device which sounds horn and shuts off engine in event of failure in air brakes, engine thermostat, oil line, emergency brakes, and emergency exit. To stop warning horn, driver must set emergency brake. Selector on instrument panel locates difficulty. When knob is turned, lights illuminate sign listing five different danger points. —BUS TRANSPORTATION

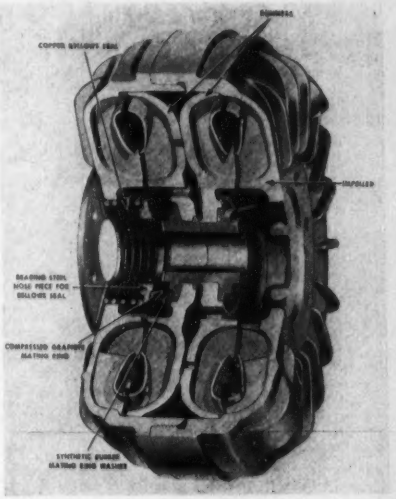
TVA NO YARDSTICK

While it probably operated at a profit in 1945, the Tennessee Valley Authority has never furnished—and without considerable accounting changes, never will—the "yardstick" it was supposed to provide for the measurement of the electric power industry. That is the conclusion of a audit-report prepared by the Corp. Audits Div. of the government's General Accounting Office. Substantial change is recommended in TVA's accounting and financing law.

The report, however, praises TVA's management "for the effectiveness with which the authority functions and for its accomplishments in carrying out the TVA Act." —ELECTRICAL WORLD

LOCATES SEA ACCIDENTS

Navy-developed Sofar—sound fixing and ranging—appears to be an effective means of locating ships in distress, planes downed at sea, and castaways in lifeboats. Bomb, set to detonate at a depth of 4,000 ft., is dropped by crew in distress. Pick-up stations, equipped with hydrophones at 4,000 ft. depth, record detonation, establishing location of detonation by triangulation, accurate to one mile. Tests conducted during the war picked up detonations over 3,000 miles away. —SCIENCE ILLUSTRATED



HYDRAULIC COUPLING—For induction motors and small engines of 1 to 25 hp. at 1,800 rpm., a new hydraulic coupling is said to prevent stalling, eliminate shear pins, and permit reversing of motors at full-load speed without high current surges. Impeller and runners are lightweight aluminum castings, the latter having cast-iron insert hubs for output shaft. Stamped steel core rings in impeller and runners form hydraulic circuit of the coupling. —PRODUCT ENGINEERING

SPEEDS PIPE MAKING

To speed output from double-length, butt-weld pipe mills, National Tube Co. has installed conveyors 3 ft. below floor level to move pipe from two butt-weld mills. Pipes pass through cooling beds in 43-ft. lengths, then are sawed in half. Chain conveyors move sections at 220 fpm. to roller conveyor which carries them to elevating turntable for straightening. Outside links, flanged, hold pipes on conveyor chain, powered by dc. motor through reduction gear.—BUSINESS WEEK

SHRINK-PROOFING PROCESS NOW STANDARDIZED

Lanaset process for shrink-proofing wool is now standardized after two years of mill experience. Process uses a melamine compound—alkylated melamine formaldehyde condensate—to impregnate fibers in an aqueous bath. Resin impregnation does not change the quality of the fiber.

Four steps are used in the process—impregnation, drying, curing, and washing. Wool must first be thoroughly scoured to eliminate processing oils and dirt. Standard 2- or 3-rubber-rolled hydraulic or pneumatic padders are used for impregnation; goods must be dry before padding. Padder pressure should be regulated to obtain not over 75% wet pickup. Approximately 12.5 to 13% of bath should be deposited on goods. After impregnation, cloth is dried, setting permanent length and width of goods. Wet goods should be overfed into drier to reduce tension. Pin tenter, loop, or vacuum drum driers can be used with temperatures up to 250°F. Flow of air to cloth must be even.

Curing polymerizes the resin into an infusible, insoluble state. Good air circulation is again important. Temperature should be 300°F.; cloth is cured in 4-6 min. After curing, cloth is washed in rope form in dolly or log washer; washing agent is 0.1% soap or detergent solution at 115-125°F. Rinsing follows. After drying, cloth may be given regular finish. —TEXTILE WORLD

COAL BREAKER CUTS COSTS

Safety is increased and preparation costs are reduced through use of a 185-lb. air-operated, scissor-type coal breaker at the Jackson & Squire strip. Two men can prepare 600 tons of coal per 8-hr. shift. To shoot a similar amount would cost 8 to 10¢ per ton.

Overburden, 37 to 40 ft. deep, is removed by 8-cu.yd. shovels. A 9-in. muck band is stripped, followed by a 6-in. layer of coal. Then another 9-in. muck band is removed, leaving a 2-ft. coal layer. Holes of 3½-in. dia., 3 ft. apart, are drilled through the 2-ft. layer. Into these holes the breaker is dropped. Breaker cylinder is 12-in. long, 10-in. dia., piston shaft is 1½ in. Cylinder and piston are attached to half bar jaws 2 ft. 2 in. long, pivoted at center by ¾-in. bolt. Air pressure between 90 and 120 lb. operates the cylinder.

Broken coal is loaded on trucks by 1½-yd. shovels. —COAL AGE

CASTERS FOR AIRCRAFT

Castering mechanism, completely enclosed with the wheel, has successfully been tested on personal planes. The castering wheel was developed by Goodyear Aircraft Corp. Angled 30 deg. with ground, a kingpin within the wheel enables the wheel to turn 25 deg. to either side of center. Compression cam and cam follower below kingpin raises plane slightly when wheel turns. Spring-loaded brake on axle corrects for shimmy; coil at top of kingpin reduces vibration and returns wheel to normal position when in flight.

Castered wheels turn into line of force rather than following crabbing of plane into cross wind. —AVIATION NEWS

PHOTOELECTRIC BATCHER

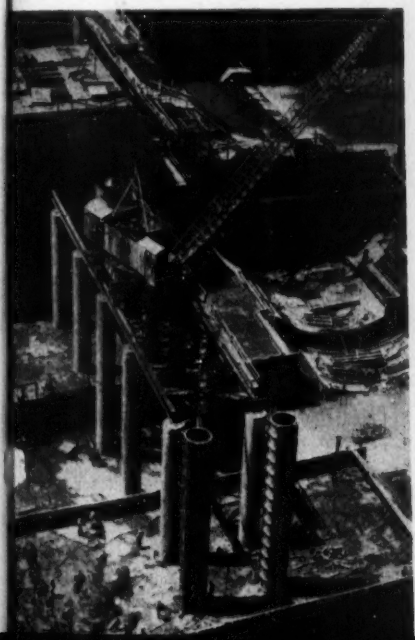
Predetermined amounts of any of several dry, free-flowing ingredients are automatically discharged into a batch by the new photoelectric Batch Weigher of Conveyor Co. It includes a dial scale and photoelectrically operated gates for opening and closing bins containing each ingredient. Movable contacts are positioned on scale dial in accordance with desired weights of ingredients. As one ingredient flows into batch, side pointer swings past contacts which flash light and activate photocell to close gate of discharging bin and open gate of next bin. This continues until all ingredients are weighed out.

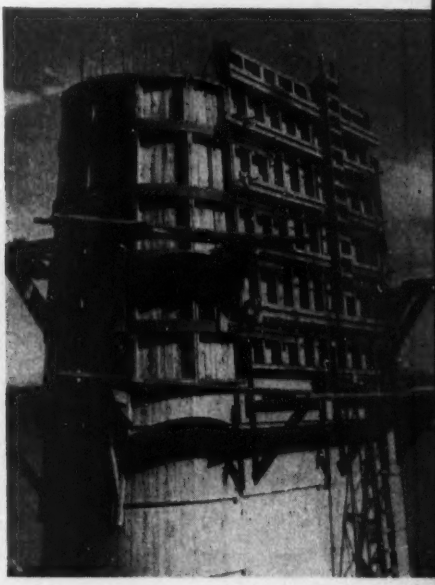
The equipment resets itself, and it repeats a cycle. —FOOD INDUSTRIES

BIG BUILDING MOVED—Two-story, 2,000-ton., reinforced concrete building was moved 250 ft. while building continued in use. Some 10,000 cribbing blocks furnished base on which railroad rails and steel rollers supported structure while anchored winch trucks pulled it. Star House Movers did the job.

Construction Techniques

ELEVATED CRANE—Supported on 50-ft. high reinforced concrete columns, a full-revolving crane moving on 24-ft. gage track handles concrete placement on Center Hill Dam. Columns are embedded in dam as concrete is deposited from 2-cu. yd. buckets in 5-ft. lifts. Dam will be 240 ft. high.





TIME-SAVING FORMS—Curved forms consisting of wood panels around which pass metal straps tightened by nuts on ends of tie rods were devised by John F. Casey Co. for noses on tall concrete bridge piers.

FROM CONSTRUCTION METHODS

PIPELINE PUSHED ACROSS 22 MILES OF MARSHLAND

Using a power winch and side-boom tractor, a 14-in. pipeline was pushed across 22 miles of Louisiana marshland in eight sections by Associated Contractors & Engineers. Mounted on pontoons, the winches were spudded in at 6-mile intervals, straddling a 2x2-ft. trench plowed by marsh buggies. Winches pulled toward them the 200-ft. lengths of pipe as they were welded into the lines. One winch worked two stretches of pipe, pushing each way lengths up to 16,000 ft.

The sideboom tractors, on plank runways, handled the 200-ft. sections and aided the winch by walking rear of pipe forward during the shove. A floating bull plug of 16-in. lightweight pipe 20-ft. long was welded to first section of each line to exclude water and bring front end above bottom of water filled trench. —CONSTRUCTION METHODS

PACKAGE PROGRESS—Oscar Mayer's wieners are now canned with a heat sealed Pliofilm sack containing the sauce (above) . . . A new double-compartment container of aluminum foil has dehydrated apples in one section, pie-dough mix in other; it is a Reynolds Metal Co. product . . . A knockdown cellulose box, with cardboard ends for added strength, is being fabricated by Interstate Folding Box Co. —BUSINESS WEEK

ELECTRONIC WARPER DRIVE

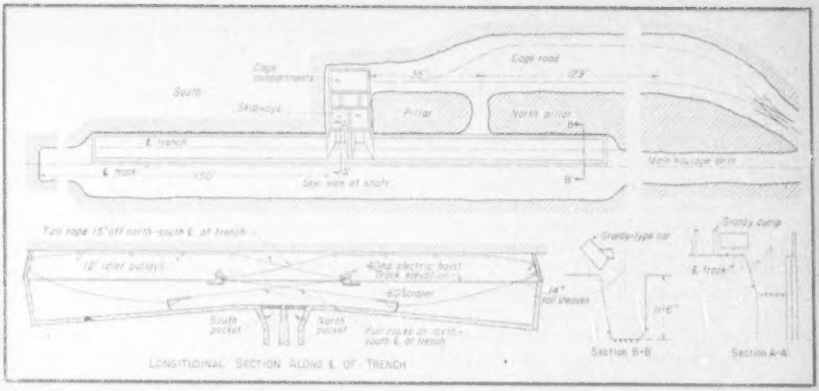
Adaptable to all spindle-drive warps, a new electronic warper drive controls yarn speed to within 1% variation throughout building of the beam. Smooth acceleration and deceleration is provided through electric braking. Drive may be inched in either direction of threading-up or picking-up of broken ends. The electronic drive eliminates mechanical linkage and cams used in rheostat- or lever-controlled drives. The electronic drive measures yarn speed directly and thus controls the driving motor speed. Source of speed signal is a dc. tachometer-generator, coupled either to the delivery roll or to shaft of compressor roll. Yarn passing around delivery roll causes roll to rotate at a speed directly proportional to yarn speed. —TEXTILE WORLD

TRENCH SCRAPING IN MINE HAS MANY ADVANTAGES

Trench scraping has several advantages over skip loading of ore from storage pockets. As demonstrated at a Cleveland-Cliffs Iron Co. mine, they are:

1. Ore in trenches is always visible to skip tender.
2. If ore is wet, excess water drains to end of trench, where it may be pumped out.
3. Wet and dry ores may be mixed during scraping to permit easier handling.
4. One man scrapes dirt into measuring pocket and loads skip; two men are required for a storage system.
5. Scraper fills measuring pocket with same capacity as 6-ton skip, eliminating spillage in skip loading.
6. Excavation of large rock volumes for storage pockets near shaft is eliminated.
7. Five or six Granby-type cars can be dumped at one point in a few seconds.
8. Several ore grades can be handled independently by using two trenches.

Essential features of trench system are shown in diagram. When ore is



Trench scraping setup for skip loading in mine. It has many advantages over loading from storage pockets.

dumped into trench, three or four passes of 60-in. scraper are required to fill one pocket. Two loaded 6-ton cars also may be dumped directly into each pocket.

Camel-back dumper of Granby-type cars is moved to new position by attaching a chain and pulling with the motor.

Through the shift, muck is scraped into measuring pocket from trench by skip-tender.—ENGRG. & MINING JOURNAL

EMERGENCY BROADCASTS

How a modern radio station picks up emergency broadcasts was demonstrated by WOR when a tenement building collapsed following fires in adjacent building. A wire recorder was sent to scene immediately. Meanwhile emergency wire lines were ordered from telephone company. On-spot interviews were recorded on magnetic wire which was sent to studio and played back on air, after editing. While this was going on, field amplifiers were set up and connected to telephone lines.

Where telephone lines are not available, portable transmitters are used. These operate on frequencies assigned for broadcast station use in linking field pickup with studio. —ELECTRONICS

NEW IN MEDICINE

New 12-oz. artificial hand, inclosed in a plastic glove resembling skin even to fingerprints, has been announced by the U.S. Surgeon General's office. Maximum force is given to the thumb and first and second finger. . . In preliminary tests, a 2% sodium fluoride solution applied as an antidecay agent to childrens' teeth has cut decay as much as 40%, according to the American Dental Assn. Solution inhibits acid-producing bacteria causing decay. It has not proved effective in adults. . . Foods, medical products, blood, and other materials are completely sterilized by an electronic sterilizer developed by Electronized Chemicals Corp. Capacitron produces short bursts of electronic discharges, propelled by electrostatic pressure, to sterilize material. —SCIENCE ILLUSTRATED

AUTO HAS BUILT-IN JACKS

Two new high-priced models of the British Austin automobile have electrically operated hydraulic jacking. Either front or back axle, or both, can be raised by operating a control on floor in front of driver. Top section of steering column is telescopic and may be lowered or raised slightly to adjust steering wheel height. —AMERICAN MACHINIST

CAVITY WALLS, SLAB BANDS CUT APARTMENT COSTS

Without sacrifice of structural quality, the New York Housing Authority adopted new building techniques to keep costs per room in its Elliott Housing project at about $1,215. Two 12-story and two 11-story apartment houses are being constructed.

High-early-strength controlled concrete was used, transported to site in transit-mixing trucks. Bottom-dump buckets from long booms with gooseneck jibs poured it. Specifications called for 1,750-lb. concrete for interior slabs on fill, 2,000-lb. concrete for exterior slabs on ground. Column strength varied from 3,500 psi. for first four floors to 2,500 psi. for top floors.

Floor system was of slab-band interior beams, 13½ in. deep, varying in width from 30 to 52 in. In a 32-ft. wide by 42-ft. long wing, slab band was positioned on a row of concrete columns at 8- to 13-ft. intervals. Near exterior end, two bands cantiliver over last column at right angles to main band, forming a T-shaped plan. Underside of floor slabs were painted, eliminating plastering.

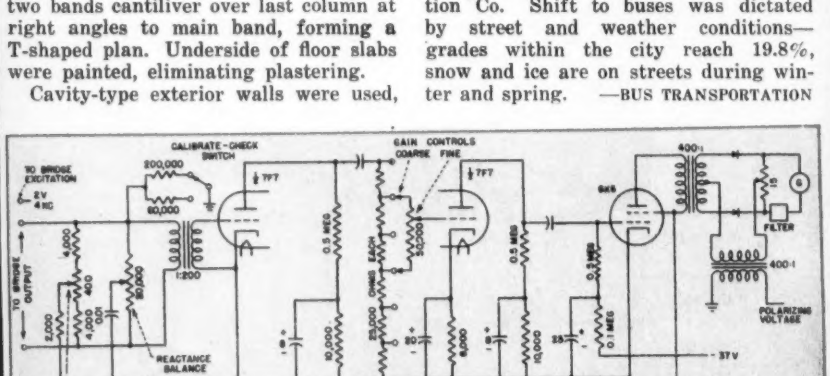
Cavity-type exterior walls were used, two withes being separated by air space. Exterior withe was face brick, interior withe of solid 4-in. cinder block. Wall was 10 in. thick. Withes were tied together by ¼-in. round bronze ties imbedded in joints. Inner withe was tied to columns by means of 11-gage galvanized wire. —ENGRG. NEWS-RECORD

PREHEAT MACHINE TOOLS?

At the beginning of the day shift, machine tools frequently are run for a warming up period to avoid production of inaccurate parts. To avoid this time-loss, thought is being given to making the machines "constant temperature." Cutting oil or lubricant can be kept at operating temperature during downtime with a thermostatically controlled electric heating element.—AMERICAN MACHINIST

BUSES BOOST PASSENGERS

Shifting from streetcars to buses resulted in a 34.4% increase in operating revenue and a 33.2% rise in passengers carried by the Penobscot Transportation Co. Shift to buses was dictated by street and weather conditions—grades within the city reach 19.8%, snow and ice are on streets during winter and spring. —BUS TRANSPORTATION



HANDY GAGE AMPLIFIER—For simplicity in industrial testing, a carrier-type amplifying system has been developed for use with different types of electric gages which measure strain, movement, pressure, and so forth. It has a flat frequency response from 1,250 cps. to 0, this being obtained by making the gage circuits modulate a conventional resistance-capacitance-coupled amplifier. The amplifier incorporates two triode voltage and amplifier stages and a pentode output stage. Designed for mechanical measurements, the input circuits are arranged to modulate the carrier frequency in the primary element itself or in its associated bridge circuit. The demodulating circuit employs dry-disk contract rectifiers. Simplified schematic diagram is shown. —ELECTRONICS

Cutting Coal Mining Costs

More extensive use of machinery seen as a way to greater, cheaper production. Coordination of management, men, and machines also is necessary

Modern coal-mining machinery is now the accepted vehicle for cutting mining costs—for higher efficiency, higher quality, higher wages, and easier work. But installation of the equipment alone will not bring the desired goal. Mining men and methods play an increasingly important role. From top management down, good employee relations must be keynoted. Mine management is realizing this fact rapidly. Good public relations in the mining community, proper training of employees, and safe working conditions all are important.

Natural conditions of the coal impose certain limitations on both men and equipment. To properly utilize the equipment, these natural conditions first must be studied. The manner in which a given coal deposit is attacked greatly affects the efficient use of both men and machines, as well as power, air, drainage, and haulage.

Since belt slopes and other cutting machinery speed starting of mines, and since distance greatly increases costs, many operators are planning "short life" mines—possibly as short as 10 yr. In that time, machinery and the deposit will be worn out and a new start can be made. Increased thought is being given by management to haulage. Costs can be lowered by planned movement of fans, power stations, man-and-material portals, and service facilities.

Deep-mining plans can be adjusted in several other respects: (1) retreat work over the entire area, (2) one-way travel by men and materials, (3) gravity drainage, (4) short-haul routes with gravity favoring the coal, (5) concentration of operations, (6) sufficient territories for mechanical loaders, (7) largest place width consistent with safety and timbering costs, and (8) enlarging territories when belts are used to move coal.

At the face, cost cutting will result from: retreat operations, concentration of working, maximum recovery to reduce per-ton moving costs, large territories providing high-volume and high-efficiency production, widening places to get maximum tons per fall, drill and shooting patterns to provide easy-to-load fall, power cutting and disposal of partings, track layouts providing short-haul patterns, machine timbering, mounted drills, power bugdusting, longer cutter bars, high-capacity and high-efficiency hauling equipment, prefabricated tracks, ties, and turnouts.

Machines improperly operated or serviced are of little benefit to operators or men. To get optimum production out of machinery is a management responsibility. Too, management is responsible for: (1) keeping equipment and mine in shape to operate without interruption; (2) seeing that materials and equipment are at the right place at the right time; (3) locating auxiliary equipment and supplies at proper points.

Only maximum coordination between management, men, and machines can insure increased coal production as well as lower mining costs. —COAL AGE

CLUB CAR BUSES

To add comfort on chartered bus trips, Johnson Bus Lines has added club car service. At present, three buses are so equipped. A radio, bar, running water, sink, and ash-tray-glass-holders have been added to 20-passenger buses. Tank for water is atop bus. Hostess serves drinks and light lunches enroute. Cost for chartered bus is slightly higher than that for a taxi. —BUS TRANSPORTATION

LATEST IN LIGHTING—Entire ceiling of this 70-ft. Austin Co. drafting room is striped with fluorescent lights between welded frame arches. One daylight and one soft-white tube in each recess will give a uniform intensity of 90 foot-candles on work. —BUSINESS WEEK

NEW PROCESS EXTENDS USE OF CARBIDE PARTS

New fields for the application of carbide machine parts are opened up by a recent development. It involves a process by which machinable materials are solidly imbedded in the carbide parts wherever they are to be drilled or tapped. This means that these parts now may be mounted or attached with screws, bolts, or studs in the same manner as parts of softer metals.

Carbide "wear parts" may be fastened by means of tapped blind holes so as to present an unbroken surface. Other applications include crank guides, cams, liners for molds and mills, punches, machine ways, work rests and shoes, and precision-instrument wear plates.

The development reduces the cost of attaching large or small carbide parts or of building up complex dies or other parts. —AMERICAN MACHINIST

DAM BUILDING SIMPLIFIED

To simplify construction operations at Norwalk Lake Dam, concrete was mixed in transit between local batch plant and damsite and placed with special buckets hoisted by crawler cranes. Nine 5-yd. transit-mix trucks handled 73,500 cu. yd. of concrete despite stiff mix and aggregate ranging up to 6-in. cobble, concrete being poured at rate of 850 cu. yd. a day.

Operating like clamshell, special 2-yd. bucket was cubical in shape for easy filling from truck chute. Full-opening bottom doors were used for quick discharge of concrete. —CONSTRUCTION METHODS

DEEP-HOLE PHOTOGRAPHY

Pictures of well bores are taken with a special camera which might be adapted to photographing interior surfaces of boiler tubes. Arranged to take either a continuous picture or a series at predetermined intervals, the compact, pressure-protected camera carries its own light source. A depth-metering reel on a special truck lowers it into the well. Photographs have been taken at depths exceeding 3,000 ft. —POWER

MAGNESIUM FIRES ALOFT

Although never the cause of aircraft fires, magnesium used in aircraft fabrication presents a serious hazard in event of fire. Common extinguishing agents are ineffective against a magnesium fire: carbon tetrachloride and water cause violent burning; CO_2 is not suitable; methyl bromide will extinguish the fire only under "ideal" conditions. To extinguish a magnesium fire, heat must be dissipated rapidly to bring metal temperature below ignition point. Hydrocarbons will reduce temperature but are

inflammable. Zinc borate pigment in primer paint acts as a retardant.

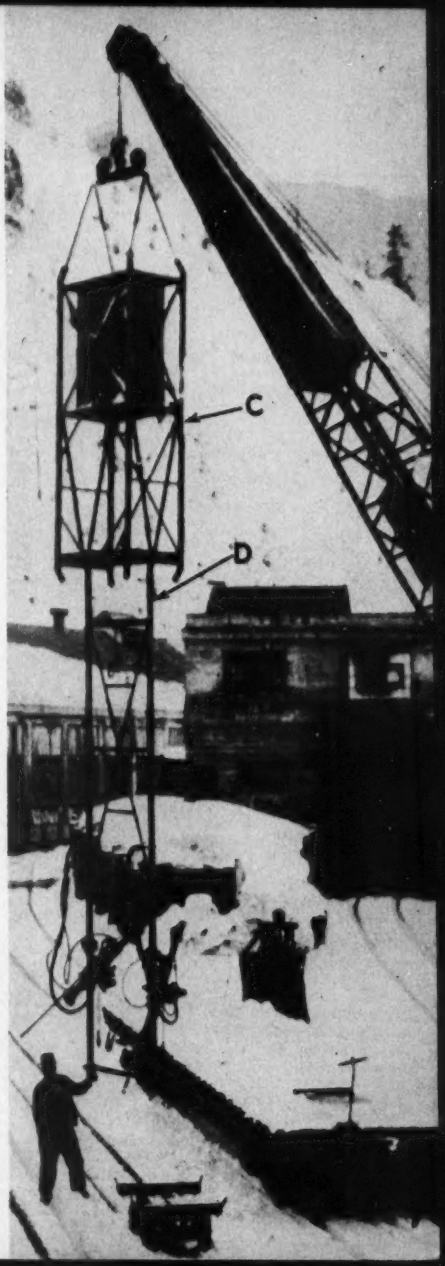
In engine-nacelle fires, burning magnesium parts should be blown free before structural failure occurs. Before magnesium will ignite, it must reach the solidus point—between the temperatures 760° and 1,200°F. —AIR TRANSPORT

AUTOMATIC HANDLING BOOSTS PLATING PRODUCTION 100%

With no added labor cost, production of electroplated metal furniture parts has been increased 100% at Daystrom Corp. It will be boosted another 30% by greater generator capacity. These increases require only 35% increase in cubic-space requirements.

Three overhead monorail chain conveyors feed parts from metal fabrication to nickel plating; nickel-plated parts to chromium plating; and finished parts to assembly. Platers are automatic, elevator-type conveyors. Racks are designed for easy loading and unloading so they can be kept on plating machine until the operation changes. Flexibility of conveyor permits a quick change to any of 40 different parts.

With variables under control, there are no rejections. For example, iron oxide formed from welding of tube was intermixed with polishing compounds and very difficult to remove. Introduction of 10% sulphuric acid, in which work can be made anodic for any part of immersion period, solved the problem, was economical. —AMERICAN MACHINIST



SINKS MINE SHAFTS—Time consumed in transporting drill equipment to bottom of mine shaft, and in setting it up and removing it, is eliminated in shaft sinking by a drill jumbo used by Hecla Mining Co. Upper part of jumbo has enclosure for water and air hoses, which connect to column pipes from C to D. Tops of pipe columns are pivoted for longitudinal positioning in shaft, and they supply air to the drills, blowpipe, and sump pump. Cross bracing is interconnected to form water manifold. Air pressure in columns also actuates pistons at bottom ends to equalize weight on each column when resting on sloping bottom. Two drills are supported near ends of columns; a third has been attached to an added crossbar, permitting use of three drifters. —ENGRG. & MINING JOURNAL

NEW PRODUCTS

Multistage Molecular Still—New type of multistage molecular still has been announced by National Bureau of Standards. It consists of a "stairway" of evaporating surfaces, each with a cooled roof directly above it to condense the vapors. Condensate runs along sloping roof and drops into next cell higher up. Spillover in each pool lets liquid run back in amount equal to condensate carried forward. Light fraction concentrates toward upper end of cascade, heavy one toward lower end. Operation can be continuous. —CHEMICAL ENGRG.

Indicates 100 Temperatures—To speed logging of multiple temperatures, Leeds & Northup Co. has developed a Speedomax Indicator capable of handling more than 100 thermocouples. When switch cuts in a thermocouple, instrument's drum scale spins and stops at the temperature to be measured. Heart of indicator's high-speed balancer mechanism is a vacuum-tube amplifier. —ELECTRICAL WORLD

Radioactive Tubing—To make it visible in darkness, a ¼-in. O.D. semitransparent plastic tubing of U. S. Radium Corp. is coated with radioactive material. —PRODUCT ENGRG.

Oils Cut Nylon End Breakage—Two new nylon-processing oils make possible sheerer and more durable nylon hosiery. Oil penetrates threads, increasing flexibility, thus reducing end breakage. Fibriub, a non-emulsifying coning oil, is applied by thrower; Sunotax, an emulsifiable trough oil applied by knitter, contains a corrosion inhibitor. Both are Sun Oil Co. products. —TEXTILE WORLD

Temperature by Color—Available in liquid, crayon, and pellet form indicators introduced by Tempil Corp. can be used to check 125 to 1,700°F. to 1% accuracy. —POWER

Simple Water Filter—Thin mats of diatomaceous earth take the place of a sand bed in the new Pur-O-Cel water filter developed by Proportioneers, Inc., for small water-treatment plants. The filter produces clear water and removes all amoebic dysentery cysts and many bacteria. It is smaller than a sand filter, backwashes easily, requires no skilled operators. Other models will be made to filter oils, juices, wines, chemical serums, cleaning fluids, liquid soap. —FOOD INDUSTRIES

Moves Tote Pans Easily—Tote pans are pulled by hook onto a small, inclined, 3-wheel hand truck, eliminating stooping and lifting. Capacity of the Easy-Tote Products, Inc., truck is 600 lb. —FACTORY

LINES PIPES WITH CONCRETE—This machine will place and trowel concrete linings in pipe lines as small as 24-in. dia., over any distance. Concrete is centrifugally placed, rotary trowels smoothing it. Operator rides a trailer to control machine and inspect lining. Liner is a Centriline Corp. development. —ENGRG. NEWS-RECORD

Adds Telephone Capacity—Three telephone circuits can be added to a line pair, without impairment of existing voice circuit, by means of a new carrier system introduced by Lynch Co. Repeaters extend range to 1,000 miles, and automatic gain regulation for long-distance service is available.—ELECTRICAL WORLD

Starter for Lightplanes—Operated by foot pedal from pilot's seat, new Righter Products Co. lightplane engine starter provides quick, positive starting on the ground or in the air. It weighs less than 8 lb.; no expensive changes or accessories are needed for installation. —AVIATION NEWS

Smooth-finish Plywood—An extra layer of pulverized wood fiber, impregnated with resin then treated with heat and pressure, gives a smooth surface to West Coast Plywood Co.'s new board. Coat takes color of wood from which it is made. It has no pattern. Waterproof, the material can be used outside. —BUSINESS WEEK

Tilts Kettles, Lifts Agitator—Operated by plant water pressure, a hydraulic cylinder introduced by Lee Metal Products Co. tilts trunnion kettles for accurately controlled pouring. It also is used to raise heavy agitator out of kettles. —FOOD INDUSTRIES

Superfine Silica Dust—Powdered silica so fine that 1 cu. in. contains 500 billion particles is now made by Monsanto Chemical Co. Used as gloss-reducing agent for lacquers and varnishes, Santocel gives furniture a desirable sheen with mar and burnishing resistance. —CHEMICAL ENGRG.

New Plastic Process—Simplified process for compounding thermoplastic materials has been announced by Hungerford Plastics Corp. The flake or resin, dye, pigment, stabilizer, extender, and filler are charged into a rotatable chamber. During rotation the liquid plasticizers are spray injected into chamber, then the mixture is dehydrated by filtering hot dry air through it as chamber continues to rotate. Resulting powder is ready for molding and extruding in standard equipment. Plastimaker eliminates use of solvents and slurries. —ELECTRICAL WORLD

Crumb Softener—Developed to make yeast-raised baking products softer and keep them soft longer, the new Merj 45 conditioner is mixed into the batch with the shortening and milk. Its action takes place during the normal baking process. R. T. Vanderbilt Co., Inc., produces it. —FOOD INDUSTRIES

Propellers De-iced Electrically—Hamilton Standard Div., of United Aircraft has developed an electrical de-icing system for propellers. For hollow steel blade, heating current is applied to special alloy wires cemented to inside surface of leading edge. For dural blade, heating element consists of layer of conductive rubber between two layers of insulating rubber. Timer cycles current to each propeller in turn. —AVIATION

Aluminum Timing Gear—Through a patented bonding process, Al-Fin Corp. is producing automotive timing gears of aluminum with steel hubs. —BUSINESS WEEK

New Textile Comb Brush—Twenty-one brush segment construction of a new dabbing brush for Noble combs permits reversing of segment or segments, thus presenting a new dabbing surface, also cutting replacement costs. Segments and frame are of lightweight, one-piece magnesium construction. Brush was developed by Fuller Brush Co.—TEXTILE WORLD

Vibrationless Punch Press—Operating up to 1,800 strokes per min., new Lemco Products punch press does not vibrate, is not bolted to floor, requires no concrete base. Force developed in press is balanced by similar opposing force. The Hypermatic is made in 10- and 50-ton sizes; minimum stock feed is 5,000 and 10,000 ipm.—AMERICAN MACHINIST

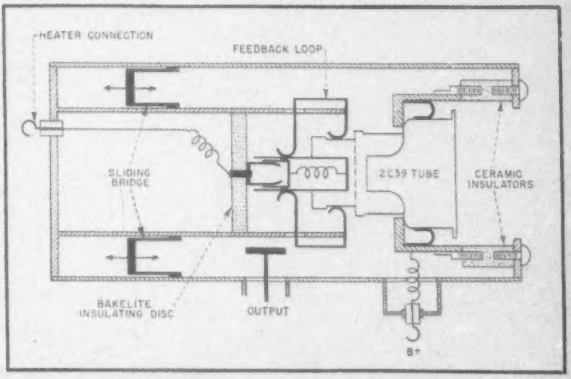
Oil Low, Engine Stops—Installed in engine lubrication system, a new pressure-activated control opens ignition circuit if oil drops below safe operating level. Pushbutton on instrument board is depressed when engine is started, and it can be held down to continue motor operation in emergency. Oilrol Co. developed it. —BUSINESS WEEK

Easily Installed Boiler—Readily disassembled into base, firebox, and shell, a new compact boiler can be taken into a building in sections and reassembled without welding. Units of the 6,000-sq. ft. capacity boiler will pass through ordinary 3x7-ft. door. U. S. Radiator Corp. developed it.—CONSTRUCTION METHODS

Electric Eye Watches Flame—If flame fails in automatic oil burner, a photoelectric scanner immediately cuts off fuel supply. Photoelectric system will withstand high ambient temperature and humidity. Unit consists of photoelectric scanner, monitering main oil burner flame, and a programming control for oil, valves, and ignition system. It is made by Combustion Control Corp. —FACTORY

Multi-Color Plastic—Multiple-color extrusion of thermoplastics in a single operation is achieved with a new Schwab & Frank, Inc., process. Placement, spacing, and volume of the materials are precisely controlled. Since the same raw materials are used, flow characteristics are identical, and there is complete fusion between different colored sections. —ELECTRICAL WORLD

STABILIZED OSCILLATOR—Frequency variations in 1,000-mc. oscillator can be reduced by capacitor in series with anode circuit. A 2C39 triode is used with 2,000-volt, 1-microsec. pulses applied to anode through coil and capacitor shunt feed. Feedback is by loops tied to cathode and extending to plate-grid cavity. Capacitance consists of open-end coaxial line surrounding anode. Tuning is by sliding metallic bridge which varies length of coaxial line tank circuit. Overall efficiency of unit is placed at 35%. —ELECTRONICS



NEW PRODUCTS

Machine Cleans Fish—A new 4½-ton fish scaler and cleaner handles 10 fish per min. Fish travels on conveyors through five pairs of rotary brushes which remove scales, then fish is slit and cleaned. A smaller model is under development. It is a product of Atlanta Machine Works. —BUSINESS WEEK

Inflated Accumulator—Consisting of a steel shell inside of which is an inflated rubber air bladder, a new full-flow hydraulic accumulator has 97% volumetric efficiency and unrestricted flow up to 50 gpm. without appreciable pressure drop. A conical plug on end of bladder seals shell opening at end of oil-discharge cycle. It is a development of Greer Hydraulics, Inc. —PRODUCT ENGRG.

Air-borne Teletype—Only 35 lb. is added to weight of airplane by Bell Telephone Lab's new airborne teletype equipment. It consists of a printer, smaller than a standard typewriter, and a converter-control unit. The latter changes the telegraphic code into frequency-shift signals in audio-frequency range for transmission over existing radio telephone equipment. When receiving it changes frequency-shift signals into electrical impulses which operate the printer —ELECTRONICS

Fluorescent Vacuum Gage—Total number of molecules per unit volume in a vacuum system is indicated through color on the fluorescent screen of the Skanascope developed by Distillation Products, Inc. It operates continuously, revealing the operative status of the vacuum system at a glance. The instrument measures 8x4½x12 in.—FOOD INDUSTRIES

Five-in-one Tachometer—Remotely connected to a central Metron Instrument Co. indicator through a selector switch, five condenser-type tachometer heads can be mounted permanently at five different machines. With three speed scales, instrument range is 1 to 5,000 rpm., full scale. —CHEMICAL ENGRG.

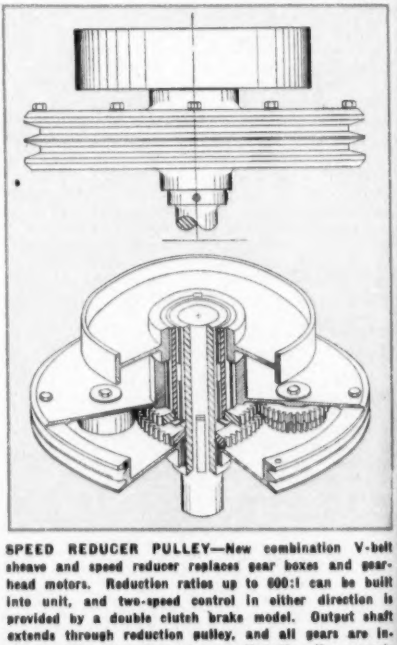
Secondary Spinning Lathes—In two sizes with up to 30-in. swing and 92-in. bed length, E. W. Bliss Co.'s new second-operation spinning lathes are designed to bulge, neck, bead, wire, flange, curl, and trim drawn or spun shells. —AMERICAN MACHINIST

Radar "Policeman"—Vehicle speeds up to 100 mph., accurate to 2 mph., can be electronically measured by a 45-lb. unit operating on 6-volt storage battery or 120-volt ac. current. Microwaves are beamed at the vehicle, radiations being reflected back to the transmitter-receiver, similar to radar operations. Operator reads vehicle speed from a linear scale. A graphic recorder can be connected to unit. It is an Eastern Industries, Inc., development. —BUSINESS WEEK

Russia Has New Magnet—Russian tests involving several thousand magnetic alloys are reported to have produced one capable of holding 300 times its own weight. This Magnico-627 has extracted broken drill fragments from a 4,921-ft. oil well and metallic particles from the eye. —ELECTRICAL WORLD

2-in-1 Safety Tire—Consisting of a "tire" constructed of rayon cords within a rubber air container, the new Life Protector inner tube has a built-in safety margin. In event of puncture or blowout, a special valve within tube holds enough air in rayon emergency tire to permit safe plane landing. The 70x25-28 tube is a Firestone Tire & Rubber Co. development. —AVIATION

Fender Protector—Small device, clamped to car fender, warns of danger to car fenders while parking. Spring, set in rubber pad, scrapes curb and activates signal on instrument board. It is a J. E. Menaugh Co. development. —SCIENCE ILLUSTRATED



SPEED REDUCER PULLEY—New combination V-belt sheave and speed reducer replaces gear boxes and gear-head motors. Reduction ratios up to 600:1 can be built into unit, and two-speed control in either direction is provided by a double clutch brake model. Output shaft extends through reduction pulley, and all gears are inclosed within the sheave in an oil bath. No separate engine clutch is required with either the single or double clutch brake models. Hart Engineering & Sales Co. introduced it. —PRODUCT ENGRG.

New Hardness Tester—Hardness of microscopic grains within steel can be gaged at as many as three places within the breadth of a human hair by a new U. S. Steel Corp. device. Steel is dented by a weighted diamond, then diagonal square of dent is measured in microns for hardness. —BUSINESS WEEK

Handles 25-ton Dies—Equipped with a 72x53-in. platform, a battery-powered lift truck capable of handling 25-ton dies has been developed by Elwell-Parker Electric Co. To load die, platform is elevated to level of press bed, then cables wound on power-operated reels slide it onto platform. Cables will place die on bed if passed under forward pulleys on platform and hooked behind near end of die. One man can perform either of the operations. —AMERICAN MACHINIST

Packaged Turkey—Cut-up turkey and eviscerated whole turkeys—wrapped in transparent cellulose, cartoned, and frozen—are food innovations. —FOOD INDUSTRIES

Aluminum-oxide Sander—Aluminum-oxide grit is resin-bonded to vulcanized fiber backing in the new Aristo Power Tools, Inc., sanding disk. Surface hardness minimizes clogging; disk retains flat shape. Disks are available in 7- and 9⅛-in. dia. and all standard grit densities. —AIR TRANSPORT

All-steel Motors—Large, all-steel, welded, squirrel-cage motors have been announced by Elliott Co. Advantages are extreme frame rigidity, 10% less weight, 25% less space, more efficient cooling system. Frames and brackets are coated with rust preventive. —CHEMICAL ENGRG.

Side-flame Heater—Flame is cast directly onto furnace walls by side flame outlets in thermostatically controlled Tonnoc Mfg. Co. liquid petroleum gas heater. Electric shut-off valve cuts off gas supply if pilot light goes out. —BUSINESS WEEK

Tangle-proof Trouble Light—Spirally coiled electrical cord for a 25-ft. extension trouble light stretches to full length in use. When released it recoils to 43-in. length and does not become tangled, drag on floor, or get caught in machinery. Kellogg Switchboard & Supply Co. makes it. —AVIATION

Electric Incinerator—For installation in kitchens or basements. Hygeator Corp.'s new electrically operated portable incinerator has a 2-bu. capacity, is said to be entirely odorless. The 20x20x32-in. unit operates on down-draft principle, is finished in red or white enamel. —ELECTRICAL WORLD

2000°F. Superheater—Rapid superheating of steam, air, and other gases is accomplished with a small, compact, gas-fired superheater developed by Selas Corp. of America. Using radiant burners, the unit can be brought to 2,000°F. in minutes. —CHEMICAL ENGRG.

LOW-HEAD MINE TRUCK—To pull coal, supply, or personnel trailers, Baker-Raulang Co. has engineered this low-slung mine tractor. Rubber tires free truck from tracks. Operator sits or lies down while driving, permitting operation in low seams. Manufacturer claims low maintenance costs for tractor. —BUSINESS WEEK

Oscillating Sickbed—Developed to combat after effects of infantile paralysis, a bed mounted on a motor-driven frame see-saws in rhythm with, and thereby assists, patient's normal breathing. It also can be used in treating respiratory and circulatory diseases. Made by Respir-Aid, Inc., bed is operated by G.E. Thymotrol drive. Speed is adjusted by turning a knob. —ELECTRONICS

Stray-current Control — To protect pipe against electrolytic damage, a current- and voltage-sensitive device has been developed by Cook Research Labs. When stray current tends to leave pipe, contactor closes to connect pipe to a rail on which current may travel harmlessly. —CONSTRUCTION METHODS

Stops Pipe Leaks—Designed to seal leaks in pipes at pressures of 240 psi., a clamp introduced by Marman Products Co. consists of a synthetic rubber pad backed by a steel plate and secured by band-type stainless steel clamps. Backing plate can be hand-formed to pipe contour. —CHEMICAL ENGRG.

For Easy Ironing—Divided soleplate of Yale & Towne Mfg. Co.'s new "tip-toe" iron permits easy ironing of ruffles, pleats, and sleeves. Main portion of soleplate is lifted, leaving the small tip flat to do pressing. Iron weighs 3 lb. 2 oz.; has large soleplate and thermostat control. —BUSINESS WEEK

FREE SERVICE TO READERS

As a special service to our readers, McGraw-Hill Digest will furnish, without any charge, additional information about any new product or technical development described in this publication. Inquiries are welcomed. Address your letter to: The Editor, the McGraw-Hill Digest, 330 West 42nd St., New York 18, N. Y. U. S. A. —*THE EDITORS*

New Cottonseed Oil Process

Continuous solvent-extraction method recovers more oil, requires less labor. To be applied in 200-ton-a-day commercial plant

Recovery of 45 extra pounds of oil per ton of seed has led Delta Products Co. to launch full-scale operation of the first continuous solvent-extraction plant for cottonseed (daily capacity, 200 tons).

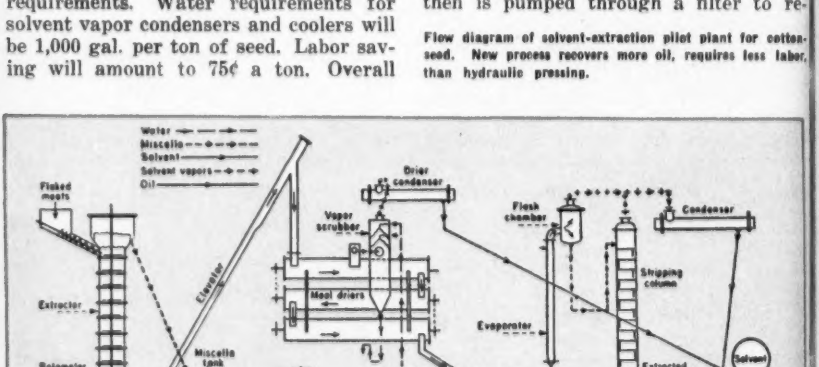
Judging from results obtained with the Allis-Chalmers pilot plant, the oil produced will have a very bright yellow color, and residual oil will amount to only 1.0-1.5%. The oil will be free of any odor or taste of solvent, contain no fine meal settlings, and be very low in moisture and volatile matter. Refineries have found it acceptable in every way for manufacture into hydrogenated shortenings, margarine, and salad and cooking oils.

Overall electric power requirements will be about the same as with the present hydraulic process. Steam for drying solvent from meal and removing solvent from oil will be about 800 lb. (at 125 psi.) per ton of seed in excess of present requirements. Water requirements for solvent vapor condensers and coolers will be 1,000 gal. per ton of seed. Labor saving will amount to 75¢ a ton. Overall gain in profit compared to a hydraulic mill is placed at $11 per ton.

How Process Operates—The extractor in the pilot plant (diagram) consists of a series of glass sections separated by slotted plates, and a central shaft revolves paddles above each plate. Rolled cottonseed meats descend by gravity through an upward current of solvent in the extractor, the solvent overflowing at top and carrying the extracted oil with it.

The meal is elevated from the bottom of the extractor to a point above the solvent level, then discharged onto a conveyor which carries it through steam-jacketed driers. Solvent vapors escape from top of driers and enter a scrubber in which hot-water spray removes fine meal particles. Vapors then go through drier condensers, and condensate returns to decanter tank.

The solvent-oil mixture (miscella) flows from the extractor into a tank, then is pumped through a filter to re-



Flow diagram of solvent-extraction pilot plant for cottonseed. New process recovers more oil, requires less labor, than hydraulic pressing.

move fine meal particles. Now it is pumped through a preheater (which brings it to about the boiling point of the solvent) and into the bottom of a long, high-velocity evaporator. It discharges from the top of the evaporator into a flash chamber, where the solvent vapors pass off to a condenser, the oil settling to the bottom. Containing some solvent, the oil flows by gravity through a loop into the top of a stripping column consisting of a series of perforated traps similar to a distillation column. Superheated steam, introduced at the bottom of the column, bubbles up through the oil as it flows down from tray to tray. Steam and solvent vapors pass off to a condenser, and the liquid flows into the decanter tank. Now free of solvent, the oil flows through a loop and into a drum.

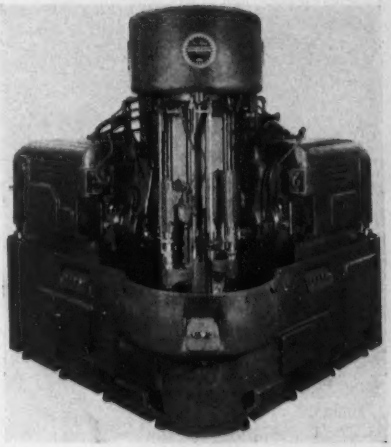
In the decanter, the water and solvent mixture separates continuously by gravity, the solvent rising to top and overflowing into a tank where it is ready for reuse. The water settles to the bottom and flows through a "gooseneck" to the sewer.

Solvent used in all tests was n-hexane with 146-158°F. boiling range. The cottonseed meats processed had been delinted and dehulled in conventional way, but contained enough hulls to provide 41% protein content in finished meal. Best extraction was obtained on cooked meats as prepared for hydraulic pressing, although raw flaked meats gave almost as good results. —FOOD INDUSTRIES

FOOD OUTLOOK

U. S. Dept. of Agriculture predicts bumper U. S. grain crops for 1947. Estimates are (000 omitted): wheat 1,212,000 bu.; corn 3,000,000 bu.; oats 1,397,000 bu.; barley 262,000 bu.; soybeans 199,000 bu.; peanuts 2,000,000 lb.; rice 72,000 bu.; potatoes 355,000 bu.; sugar beets 11,500 tons. —BUSINESS WEEK

World food situation in 1947, however, will be only slightly brighter than in 1946, despite 7% gain over the previous year. In much of the world, food consumption is at or above prewar levels. Most seriously hit by food shortages will be Germany, Austria, Rumania, Russia, and the Far East. —FOOD INDUSTRIES



FAST GEAR SHAVER—GCS Turmatic gear-shaving machine developed by National Broach & Machine Co. is said to increase production 2½ times over prior models. A central turret has four vertical sets of headstock and tailstock. Two cutter heads 90 deg. apart simultaneously mesh with work gears on adjacent turret faces. Then turret indexes 180 deg. and presents two fresh gears, leaving other stations for loading. —AMERICAN MACHINIST

SYSTEM FOR SALESMEN

To provide continuous checks on customers' back orders, up-to-the-minute information about customers for salesmen, and to minimize office work for salesmen in the field, Carolina Machinery & Supply Co. has instituted a novel information service for its field men. Copies of all orders, queries, quotations, office memoranda, and other information on prospective purchasers of supplies are filed in folders tabbed by prospect's name. Company salesmen divide their sales territory into thirds, working one third each week. Folders of prospects to be visited during the week are collected; other folders remain in office to be kept up to date. —MILL SUPPLIES

RAIL REMOVER—To remove 122-lb. trolley rails from 19 miles of street at rate of 1,000 ft. in 3 hr., Honolulu Rapid Transit Co. developed a special extractor. It consists of a pair of 60-ton hydraulic jacks exerting a powerful upward push on the ends of horizontal steel channels from which two rail-gripping clamps on vertical hangers are suspended. Machine is mounted on steel I-beam skids carrying a pair of welded A-frame guides between which two channels extend horizontally. Welded steel plates under ends of channels take force of jacks. —BUS TRANSPORTATION

METALWORKING SHOW TO BE OF WORLDWIDE INTEREST

More than 100,000 executives from the metalworking industries of the world are expected to attend the large Machine Tool Show at Chicago, Sept. 17-26. The exhibit will include more than 1,000 cost-cutting machines in the 250 exhibits at the Dodge plant.

This is the first important international metalworking show to be held in 12 years, a period during which far-reaching progress has been made in machines and methods. Much of the equipment will be in actual operation.

At the Machine Tool Congress, held concurrently with the show, there will be papers and discussions on latest developments. Events of particular interest to visitors from overseas will be included in the program.

Hotel reservations will be handled by the Chicago Convention Bureau, 33 North LaSalle Street, Chicago, Ill., USA, and they can be made through travel, steamship, and airline agencies. Machine tool dealers abroad have hotel reservation and registration blanks. The latter should be sent to National Machine Tool Builders Assn., 10525 Carnegie Ave., Cleveland, Ohio, USA. The U. S. consulates have been supplied with information about the show. —*Special report to McGraw-Hill Digest*

ALUMINUM-SILICON FROM CLAY

Alloys of aluminum and silicon are produced from ordinary white clay by a method which Tennessee Valley Authority developed. Clay is heated in a kiln to drive off water, then fed with coke to an electric furnace where the materials react to form aluminum-silicon alloys. These were used successfully in large-scale tests for deoxidation of steel and for reduction of dolomite in making magnesium. There has been much interest in the possibility of extracting aluminum and silicon. —CHEMICAL ENGRG.

WARMS CONCRETE AT 0°F.

In spite of winter weather, thin-wall concrete silos were poured with slip forms by A. H. Neumann & Bros. Gasoline-powered and fueled fan heaters on sliding forms directed hot air inside canvas enclosure and kept temperature at 45°F., or higher, although it dropped to zero outside.

The canvas, wood battened, inclosed the

outside form and scaffold area to protect the fresh concrete and the finishers. Canvas extended above forms and could be draped over top of cell walls for further protection. —CONSTRUCTION METHODS

NEW BUILDING MATERIAL

Produced from thermally expanded obsidian, similar to perlite, a new construction material has unusual properties. When mixed with cement, the strength is claimed to be 2.5 times that of sand-and-cement, weight one-third, insulating value 4 times. Fireproof and with virtually no capillary attraction, the material has been used experimentally in storage tanks, floats, firebrick, wallboard, and pipe coverings. It is thought to have possibilities as a plastic filler. Continental Basic Materials Corp. developed it. —CHEMICAL ENGRG.

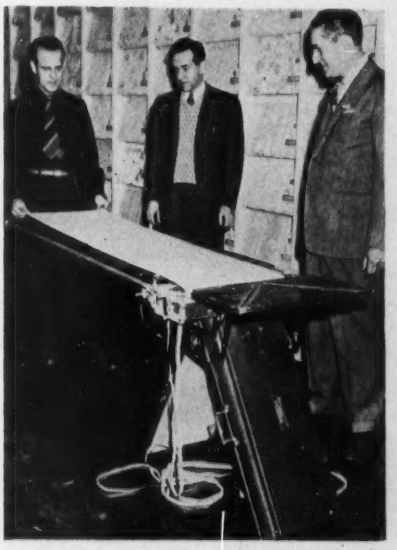
TWO-WAY RADIO ON BUSES

Intercity buses operating on Greyhound lines in the Chicago area are tied to the central dispatch office by two-way radios. Weather and passenger information, delays, and arrival times are broadcast by the driver. Frequency-modulated, 42-mc. radiotelephones are now installed in 150 buses. Central sending-receiving stations soon will be added in seven other cities in the area. Plans are for a nation-wide network, stations so placed that coast-to-coast buses would never be outside range of receiving stations. —BUS TRANSPORTATION

WHAT'S NEW IN AIRCRAFT

Flight tests have been completed on Waco's new *Aristocrat*, 2-place personal plane with emphasis on safety. Nose wheel is either steerable or castering for crosswind landings. Control wheel is of steel tube designed to bend without breaking in event of crash. Landing gear keeps propeller clear of ground even when retracted. Propeller is a pusher, mounted between two large fins and the stabilizer to prevent walking into the turning blades. The 215-hp. Franklin engine gives a cruising speed of 152 mph. at 5,000 ft. Service ceiling is 17,500 ft.; range, 657 miles. It will sell for $9,980.

Sweden's first jet-propelled plane, the Saab Aircraft Co.'s J-21R, has successfully passed initial flight tests. It's a modified twin-boom, pusher-type J-21, equipped with English "Goblin" engines. The J-21R is a transitional step to the Saab 1001 jet plane designed for 652 mph. . . . W. L. LePage, designer of Platt-LePage helicopter, suggests the use of large, wing-tip propellers capable of being rotated to the vertical and becoming lifting propellers. Low-speed landings and takeoffs in bad weather would thus be possible. Two 90-ft. propellers would be required to lift a plane of DC-4 size. —AVIATION NEWS



PASTES, TRIMS WALL PAPER—Trimming and pasting of a roll of wall paper is completed by this machine in 2 min.; paper hanger requires 15 min. for same operation. Folding into a suitcase-sized package, the machine eliminates need for pasting table and accompanying mess. It is a Hyde Mfg. Co. development. —BUSINESS WEEK

HIGHWAY CONSTRUCTION TECHNIQUES DISCUSSED

At a recent meeting of American Association of Highway Officials, useful suggestions were made in respect to highway construction and maintenance. The most significant reports covered latex crack filler, ice and dust treatments, membrane curing of concrete, subgrade density, soil-cement bases and subgrades, and resurfacing of old concrete roads.

Latex Crack Filler—California successfully used a mixture of latex and asphalt as a filler for cracks in concrete pavements. Before the war, natural latex was used; now Buna S is employed. SC4 or SC6 asphalt is mixed with the synthetic latex, then poured into the cracks. Filler is applied cold at a cost of $1.50 per gal. Powdered sodium fluorosilicate is used as a congealing agent.

Ice and Dust Treatment—In combatting highway ice, the British Columbian Highway Dept. found that excessive sand filled subgrade drains and too frequent application of salt had a deteriorating effect on concrete. They suggest using a power broom to redistribute automobile-moved sand. Broom gives a rough surface to ice as well as respreading the grit. Dust on secondary roads, says the Missouri Highway Dept., can be combatted with 0.7 gal. SC2 road oil per sq. yd. of surface. Potholes will form, but dust is definitely reduced.

Membrane Curing of Concrete—Although use of membranes for curing concrete was adjudged satisfactory, many state officials believed mat or paper curing was more satisfactory. Mats or paper provide a definite cover and allow addition of water during curing.

Density of Subgrades—One state recommended that compaction minimums be stated in number of passes by sheepsfoot rollers rather than by density, as this would eliminate much laboratory work. In California, engineers recommend using 8-in. layers for fill work except that 4-in. layers be used in the top 2½ ft.

Soil-cement Bases, Subgrades—Tests run by the state of Washington show that soil-cement bases should be prepared under favorable weather conditions. In a 6-yr. test, one road section, built in favorable weather and surfaced lightly with bituminous treatment, gave satisfactory service. Another road, built in late fall, too late for bituminous treating, scaled badly and peeled under traffic the next spring. The state uses a 4-in. soil-cement mixture subbase for concrete pavements.

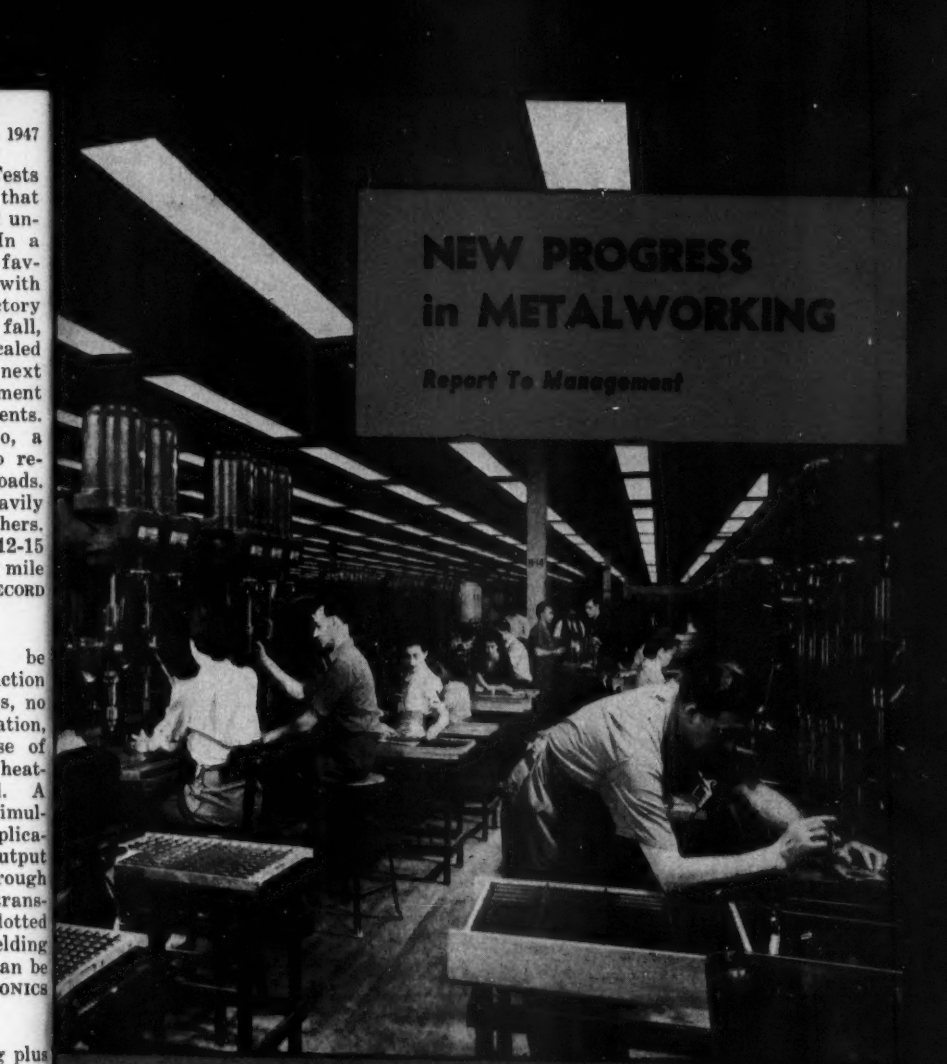
Resurfacing Old Roads—In Ohio, a dense graded plant mix is used to resurface scaled or broken concrete roads. A 4-in. layer is employed for heavily traveled roads, a 2-in. layer for others. Such topping extends road life 12-15 yr. A 3-in. coat costs $18,000 per mile for two lanes. —ENGRG. NEWS-RECORD

ELECTRONIC WELDING

Vacuum-tube subassemblies can be welded by 250-400-kc. local induction heating, with no wear on electrodes, no work contamination, little deformation, and with precise control. Because of the energy concentration and short heating time, little power is required. A complete weld can be formed simultaneously by proper shaping of applicator coils. About 100-kw. r-f. output power is fed to applicator coils through a step-down impedance matching transformer in which secondary is the slotted core. With phototubes to time welding and with indexing, sub-assemblies can be formed automatically. —ELECTRONICS

RAISES FOUNDRY OUTPUT

Installation of mechanized handling plus smoke tunnels and shakeout hoods at Lynchburg Foundry Co. has increased per man-hour production 250%. Total employment has nearly doubled. Shakeout hoods draw 130,000 cfm. of air from outside. Molds now travel into smoke tunnel over loop conveyor in a matter of seconds after pouring. Loop can handle castings up to 300 lb., mold and flask weighing up to half a ton. —FACTORY

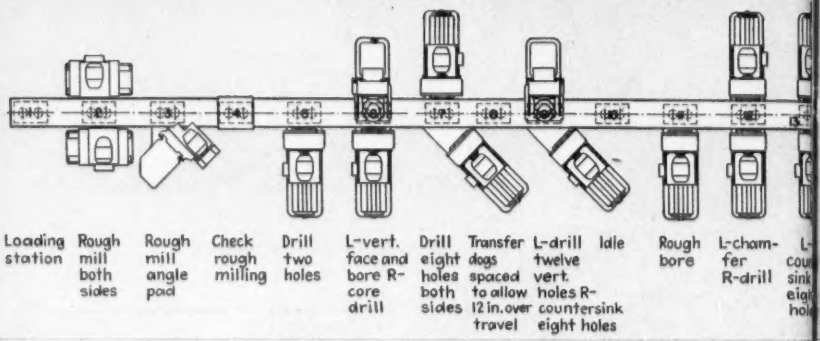


NEW PROGRESS in METALWORKING

Report To Management

Probably no other development will contribute so much to the world's future industrial progress and to a higher standard of living as will new machine tools and metalworking methods. Tools recently have become available which are faster, more accurate, and more simple to operate. These will produce more and better products at lower cost and with relatively few skilled workers.

Because of the basic importance of metalworking, McGraw-Hill Digest presents in the following pages a report on recent developments. It was especially written by a McGraw-Hill authority on the subject, E. J. Tangerman, Managing Editor of *American Machinist*.


Loading station
Rough mill both sides
Rough mill angle pad
Check rough milling
Drill two holes
L-vert. face and bore R-core drill
Drill eight holes both sides
Transfer dogs spaced to allow 12 in. over travel
L-drill twelve vert. holes R-countersink eight holes
Idle
Rough bore
L-chamfer R-drill

This automatic transfer machine turns out refrigerator compressor bodies at the rate of 188 pieces an hour. Two workpieces on a single fixture are conveyed through 2

Major Improvements Made

Demands of war production upon machine tools resulted in tremendously increased feeds and speeds, development of cycle control and automatic handling and clamping equipments, and combination of units or even entire machines to reduce the amount of human labor per unit of product.

Speeds were multiplied in cutting ferrous materials by development of less-brittle cemented carbides, by use of obtuse cutting angles (negative rake), and by better mounting to increase support and enlarge chip clearance. In older cutting materials, improved heat-treatment and grinding and use of "cushioned" support permitted faster cuts and increased life between grinds. Adaptation of the friction-sawing principle to bandsaws makes it possible to saw shapes at greatly increased speeds with a "dull" blade traveling at about ten times normal surface speed.

On lighter alloys and plastics, tremendously increased speeds have been attained, replacing conventional milling cutters with flycutters, usual hand motors with high-cycle units, and so forth.

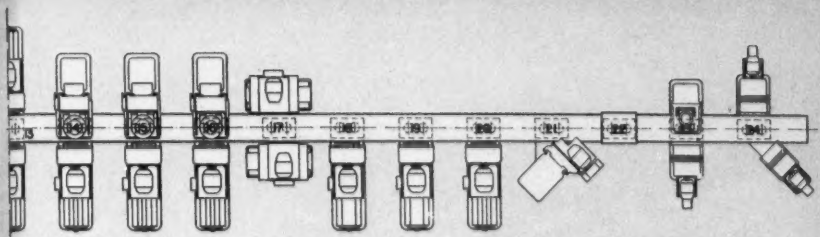
Feeds were increased by providing hydraulic devices or variable-speed motors to permit exact feed selection. Noncutting time was reduced by providing rapid traverse for approach and return, even for short distances. Automatic cycling, readily adjustable by the operator, handles rapid traverse without danger.

Manual and pushbutton controls have been grouped and even duplicated on opposite sides of machines for ease of control. Electronic and motor-generator rectifier units have been built to rectify usual alternating current to direct current for speed variations, dynamic braking and "inching." Increase in the number of motors per machine makes it possible to control each function independently.

To provide special machine advantages for limited production without excessive setup or investment, several methods are used. One is the tool that can be operated either manually or automatically, the changeover being made in seconds. Some of these units set the automatic cycle as the operator handles the first cycle manually.

Another method is to combine self-contained milling, drilling, tapping, and other heads on a special base. In one case of this sort, lathe heads and tool-slides are each separately motored, self-contained units connected in desired numbers to the machine base only by a flexible conduit. The slide has its own chang

COVER PICTURE—In modern naval ordnance plant, drill-press operators work to tolerance of 0.0005 in. Temperature and humidity are controlled. Good lighting aids accuracy, and insulated ceiling deadens noise in this Austin-designed plant.



stations while 31 different operations are performed using 152 tools. The installation is a fine example of the most recent advances in mass production.

gears with micrometer stops to control feed and rapid return.

Still another method is to apply special tooling to standard machines. The Germans made extensive use of this device.

Multiple operation, the application of several tools to the piece at once, has been extended. Multiple cuts are now applied to grinding, gear-cutting and broaching. Further, the familiar multiple-spindle machine is now supplemented by the multiple-station machine, really a series of machine tools set up in a line or a loop and joined by automatic-transfer devices and interlocked controls. A recent installation of this type has 24 stations. Dozens of others are going into automotive plants to reduce labor cost per piece, for one or two operators handle the whole line.

War demands for tolerances of tenths and hundredths of thousandths of an inch forced many shops to learn precision techniques. These shops learned that parts to such tolerances could be assembled more easily, ran more smoothly, and actually could be produced more economically in quantity. So they are applying similar tolerances to peacetime products. This requires machines with greater rigidity, better bearings and bearing surfaces, improved lubrication, plus atmosphere control in machine and room.

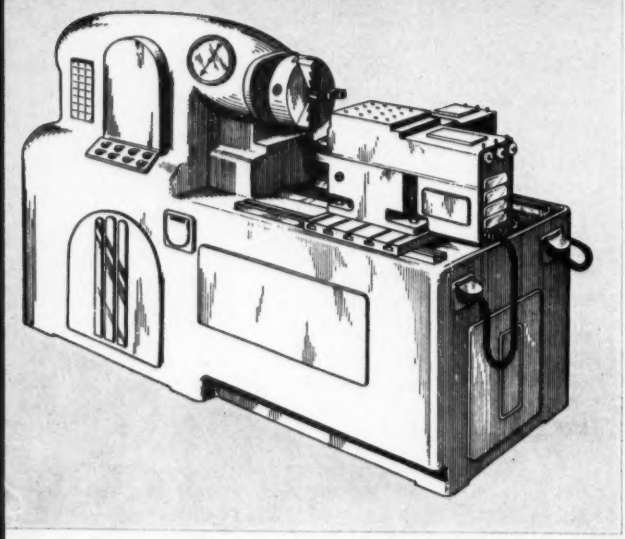
Accuracy requirements also have stimulated application of built-in automatic sizing devices—pneumatic, electric, and hydraulic, as well as mechanical. Micrometer adjustments for tool settings are being provided also.

To reduce machine down time, some units now have interchangeable tool heads so one can be used while tools in the other are reground. Alternate-feeding or rotary tables permit loading of one part while another is, or several others are, being machined. Quick-acting clamps and chucks are faster and surer than manual workholding. To reduce downtime for maintenance, electric controls are concentrated on door panels or just inside, hydraulic lines and units made accessible, motors provided with quick-removable mountings and set near adequate doors. To avoid the need for repair from accident, interlocks are provided in circuits requiring certain pressures, temperatures, or potentials.

So much for trends in general. Here are effects, process by process:

Better Turning Machines

A turret-lathe attachment will automatically duplicate any job within machine capacity. The first piece is machined manually, the automatic control being locked for each tool setting, and the machine is set for automatic cycling. However, the operator may interrupt at any instant to vary a dimension or even to machine a different piece. When he



In this automatic lathe, individual motor-driven compound rests can be grouped about the spindle in any desired arrangement. Advantages of single-purpose operation are thus combined with versatility.

finishes, he can switch back to automatic control without effect. Micrometer adjustments on feed dials and stops allow compensation for tool wear without resetting the machine. Such a machine is set easily and is more accurate than a manually controlled one, thus can handle lots of as few as ten pieces economically.

One engine lathe, with the throw of a lever, becomes a semi-automatic unit for first and second operation work on gear blanks, straight and flanged bushings, and various shafts. The front carriage has a cycle including power-driven longitudinal feeds toward the headstock and rapid return. A rear carriage for facing and necking is separately motored and cycled. Maximum spindle speed of 3,000 rpm. is possible with "mist" headstock lubrication.

A turning, facing, and boring machine has conventional lathe base and headstock, but a flat bed with T-slots. On these slots, one to three motor-driven toolslides may be set, each mounted on a swiveling base to permit machining from any angle. Each toolslide rapid-traverses at 100 ipm. until the working portion of its 4-in. stroke is reached, then can be set to dwell a desired number of seconds or rapidly return. Feed can be ¼ to 13 ipm. by change-gears. Adjustable micrometer stops control feed and traverse elements of the cycle. A flexible cable provides the only connection with the base, so one preset slide can be retimed with reference to another without disturbing settings. Other forms of this same machine have separate headstocks as well.

One automatic chucker is heavy but compact, with spindle center at elbow level, and plenty of loading clearance with slides withdrawn. The pneumatic chuck is pedal-controlled. Two main slides, longitudinal and crossfeed, are cam-controlled. Telescoping chip guards below the chuck pass chips, dirt, and coolant quickly to the pan, served by chip conveyor.

A five-spindle automatic has sliding-adjustment quadrants to replace conventional cams, hence handles production lots too large for the turret lathe, too small for the usual automatic. Cross-slide strokes are also controlled by adjustable linkages. A center and two independent longitudinal slides, four cross-slides, and a separate cut-off slide provide tooling flexibility. Cross-slides have separate micrometer adjustment. Like others, the unit has a chip conveyor.

A high-production automatic screw

machine is designed to handle quantities of 25 or more pieces with quick setups. It has a power-feed ram turret, hand-operated cut-off slide, preselected spindle speeds of 50 to 5,000 rpm., feeds from 0.0005 to 0.016 in. per spindle revolution. Drive is by dc. motor, and a motor-generator set and electrical cycling control are incorporated.

To take brawn out of chucking, one collet chuck has an electric booster, another a built-in electric chuck wrench beneath which jaw screws index on stopping.

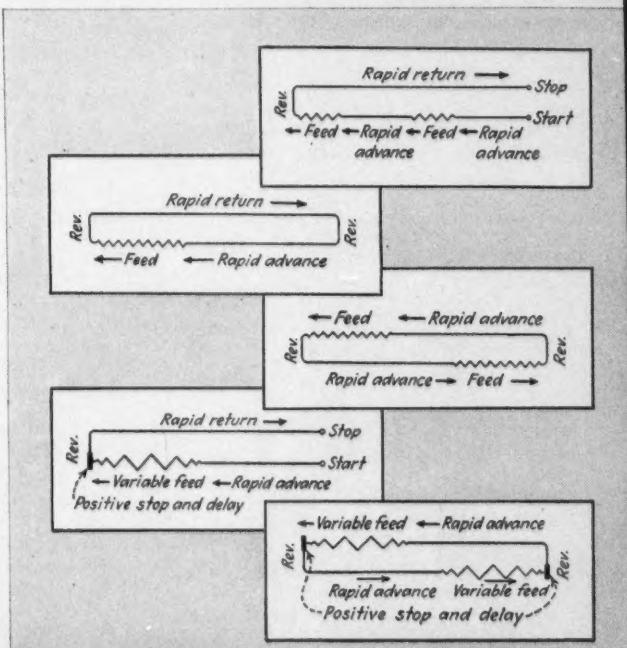
Faster Drilling

Multiple drilling is now the rule. One form of machine has heads feeding from required directions to the piece held in a fixed position. An example is a tractor crankcase, in which 98 holes are drilled with multiple heads working from three directions.

Multiple drilling, reaming, counterboring, spotfacing, and tapping — even milling — also may be done on rotary-table machines in which the table is indexed to come successively under a series of spindles. Another variation is the horizontal drum indexing machine, one used on rocket end plates having 34 spindles and hydraulic drive. Multiple-station machines, described earlier, are really large multiple drills, the normal heads being replaced by separate machine tools with their controls electrically interlocked. As in the rotary-table machines, indexing must be completed, clamping finished, and the cycle gone through at each station—or the interlock system shuts the machine down, showing the trouble at the same time on a panelboard.

Drills in combination with electronic balancing machines have been developed to balance everything from a tiny gyro rotor to an auto crankshaft. One for balancing six-throw auto crankshafts has electrically interconnected balancing unit and 6-spindle drill. The balancing unit measures unbalance at each of six points and sets stops on each drill, then the piece is shifted on a dolly to the drill, where the holes are drilled within 0.003 in. Total time per shaft is about 2 min.

Automatic milling machine feed cycles now may be obtained in many combinations. "Cutting air" is minimized by rapid advance, automatic reverse, and quick return. Any feed within the range of the machine may be used.



Carbides Speed Milling

As a result of extensive experiments, as well as practical experience, milling speeds for the carbides now range from 300 to 700 sfpm., with chip thickness not less than 0.010 in. for economy in power consumption and tool life. These heavier cuts, coupled with employment of a variety of radial and axial rake angles (many "negative" to give an obtuse cutting edge) have required machines with much more power. One line of knee-type machines, for example, are in 20-, 30- and 50-hp. sizes, with 16 quick-change spindle speeds from 50 to 1250 rpm. and 32-quick-change feeds from 3½ to 90 ipm.

To handle production runs with carbide, greater rigidity and power are built in, as well as flywheels to even out the rotating speed of the cutter spindle. On such machines, it is possible to production-mill steels heat-treated to 400 Brinell.

On the aluminum alloys, speeds of 20,000 fpm. and feeds of 240 ipm. have been used successfully. On such units, the major problem is chip disposal.

Climb milling, where cutter teeth rotate down onto the work instead of upward through it, has been found to increase cutter life. To use it successfully, backlash eliminators take out lost motion in the feed mechanism. One maker has adopted an overarm dampener, a compensator inside the overarm to reduce vibration.

Automatic feed and rapid-traverse cycles, with rise-and-fall tables to clear the cutter on the return, now can be provided in almost any combination of interrupted cuts with uniform or variable speeds.

Contour-milling machines have been arranged for multiple spindles to produce several parts from a single master. Some have hydraulic control, so verticals can be used for die-sinking, horizontals for profiling 360 deg. in a horizontal plane, the combination being employed to handle irregular shapes in three dimensions.

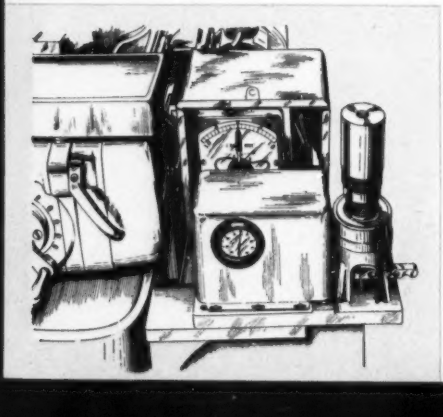
Quick-loading fixtures, many hydraulically or electrically operated, are extensively used to reduce loading and unloading time.

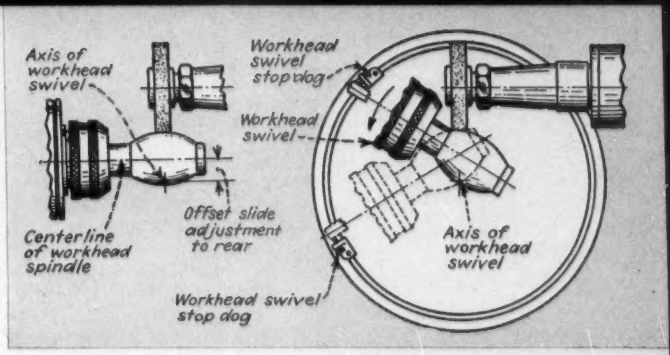
Boring mills are being adapted to special purpose jobs. One for producing railway-car wheels from 33 to 40½ in. in dia., combines a boring and facing head, a run-turning head, and two side heads, all automatically cycled and with their own feed motors. The 100-hp. main drive motor provides a table speed of 5 to 25 rpm.

Both of the side heads incorporate taper attachments to generate the tread and flange. Accuracy and finish are improved and production multiplied by six or more. Wheels are centered in chucking so rim thickness is balanced when machining is completed.

Another machine for car wheels replaces traditional work rotation, with tool rotation. Work is brought in and taken out by a special carrier, and the table is a two-position unit so one wheel can be chucked while another is in process.

This gaging device enables a grinding machine to finish an inner roller-bearing race to mate its corresponding outer race with a specified clearance. The outer race, set on the stand (right), makes contact with a tapered plug through three balls which limits the grinding cycle.





Tool grinders will cut internal and external radii on end mills, reamers, counterbores, and form cutters with straight, tapered or helical teeth. Other machines will grind irregular contours.

Grinding, Honing, Lapping

Close tolerances and fine surface finishes are both achieved by grinding and honing or lapping. Cylindrical grinders now are equipped with automatic sizing, in one case with electrical gage heads which measure directly and stop the grinding cycle within tolerances of a tenth of a thousandth. A pneumatic gage is similarly used for bore gaging and control. Other forms have been used for longitudinal control, in each case also providing a visual indication for the operator. An innovation is an automatic gage which sizes the ball groove of an inner bearing race, not to a predetermined diameter, but in relation to the mating groove in the outer race. This avoids the need for selective assembly. A tapered plug within three balls running in the outer race transmits a measurement to an electromagnetic gage, as does a contact diamond riding in the raceway of the bearing being ground.

Multiple-grinding-wheel setups are being developed to reduce number of operations. Several wheels may be mounted on a single spindle, or several wheelheads may each carry one or more wheels. In one case, four main bearings are ground at once in a machine with two twin-wheel slides. Wheels set at an angle in such machines frequently combine cylindrical and facing operations.

Recent developments in internal grinders permit such grinding to be done on the centerless principle and also have achieved accuracies and finishes once thought obtainable only by lapping or honing.

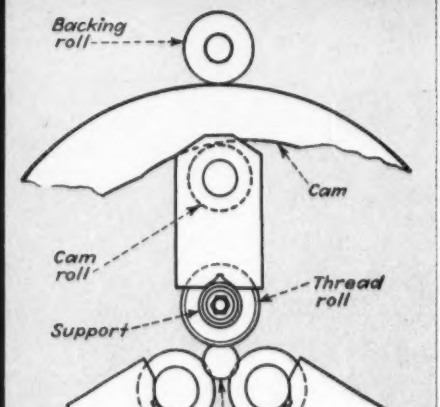
To speed production grinding, automatic controls with rapid approach and withdrawal have been developed, and automatic loading is also used, including hopper feeds on centerless units.

Contour grinding, on which the wheel is dressed to the inverted shape of the workpiece, has offered many economies. For simple shapes, dressing is done with a diamond; for more complex ones, a hardened steel roller having the same peripheral contour is forced into the wheel to break down the bond, thus reproducing its own shape in the wheel periphery. Wheels so shaped can be used either for cylindrical or surface grinding, with either plunge or traversing cuts.

Improved wheels, careful machine adjustment, and proper operator training now make it possible to surface-grind to limits of 0.0003 in. and a finish of a few microinches. Diamond wheels of new types can grind optical-glass prisms, ceramics, quartz, and sapphire. Such materials have also required development of special fixtures.

Toolroom-cutter grinders are now able to grind contours, providing correct clearance or backoff across the entire face of a milling cutter, follow a helix angle, and apply effective rake angles.

Improvements in grinding techniques have somewhat reduced the need for lapping, but multiple-spindle hydraulic honers still finish cylinder bores.



Precision threads are formed with dies without the removal of any metal. This machine uses three cylindrical dies fed inward simultaneously by means of a hydraulically rotated cam ring.

Planers Improved

To achieve the higher speeds and ease of control obtainable with other machine tools has demanded special work on planers. Dynamic braking has been applied to stop the table, and special forms of drive to provide quick reverse and a wide range of speeds. Controls for heads, table, and crossrail now are centralized. Automatic feed is tied in with table movement. Hypoid gearing permits the driving motor to be set at an acute angle to table travel, and flexible couplings reduce the shaft bearings required and former troubles with alignment.

Way lubrication has been a problem. Pressure lubrication merely lifts the table, and the usual oil will not flow freely at much more than 200 fpm. Return speeds up to 400 fpm. have been attained, however, by connecting the ends of the way and channels with a pipe loop. Oil is thus collected at the rear and forced to the front, pressure rising with the speed. To overcome temperature rise from way friction, with consequent table bowing, laminated plastics are being applied for way surfacing.

To avoid a smashup if the loaded table runs off the bull gear, various forms of safety stops have been developed. One is a pair of broad cutting edges which absorb kinetic energy of the table by cutting 1/16-in. chips from the table hold-down until the table stops. Another is a hydraulic jack struck by a projecting block under the table.

Threading Innovations

Military insistence on Class 3 and 4 fits forced a shift to ground taps and dies, in machines which were not only smooth running but also guided the tool. In many cases, positive feed through a leadscrew proved advisable. One such machine combines a hob as an extension of the precision-ground leadscrew. This hob is used to cut internal threads in two solenoid-actuated brass fingers which thereafter serve as a leadscrew nut. Whenever blacklash appears, the fingers can be rethreaded. This machine also incorporates depth control to a tenth of a revolution in tapping to a shoulder or into a blind hole.

Many threads are now ground, fine-pitch ones, from the solid. This is particularly helpful on heat-treated parts which may have been distorted slightly. Both internal and external threads can be ground, providing diameters are large enough to permit use of an abrasive wheel. A recent innovation is centerless thread grinding with a crush-dressed wheel first trued and chamfered with a built-in diamond. Thread ridges are annular, through-feed of the workpiece being obtained by feeding it at the thread helix angle in relation to the grinding wheel. Work is supported by a narrow guide and a plastic backing wheel soft enough not to mar it.

A recent modification in thread rolling is a machine which first forms a point

chamfer. Another is a machine with circular dies. It may be horizontal or vertical and have two or three rolls. Hydraulic roll feed is considered smoother and easier to control. Thread-rolling machines now are being applied to many other jobs, such a knurling, chamfering, flanging, serrating, and threading small worms. The machines even are equipped with longitudinal feed so long bars can be threaded.

New Sawing Methods

Friction circular sawing has long been familiar as a method of cutting rails and heavy bars to length. The same principle has now been adapted to bandsawing, particularly the harder, tougher steel alloys. A dull blade, run at about ten times normal surface speed, literally burns its way through the metal to be cut, but neither the blade nor adjacent surfaces are burned in the process.

Contour band sawing has been widely applied in die and tool making to produce both male and female members in a single cut. Special bands of file sections and sanding bands also increase the versatility of these machines.

Use of Broaching Extended

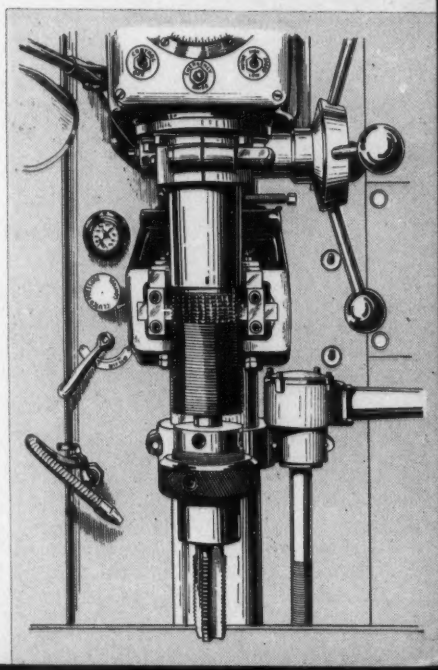
Irregular-shaped war-item parts, new materials, and new designs of tools combined to bring broaching into greater prominence during the war. It is now possible to surface-broach parts to a finish that rarely requires additional finishing, handling in one pass surfaces that formerly required a dozen machining operations.

A war-developed variation was circular broaching, in which graduated teeth on the periphery of a disk do the cutting. Such complicated sections as circular T-slots are now machined in this way.

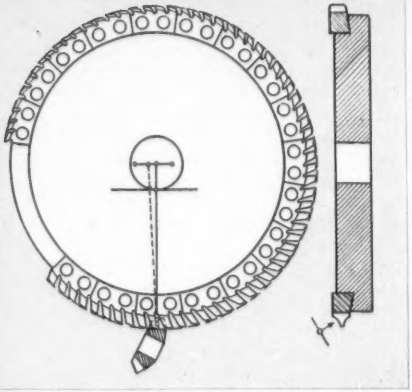
Internal broaching—the first applications of which simplified forming of keyways, inside squares and polygons, ratched teeth, and odd contours—was adapted to rifling guns to give better surfaces than single-point tools, and in a fraction of the time. Rifles and small field guns were rifled with a series of long broaches, pulled through in turn. Larger guns were broached with a series of as many as 30 flat disk cutters pushed through singly. On high-production jobs such as machine guns, automatic loading fixtures were used.

Broaching machines with capacities up to 50 tons are now available. Some have single rams, but an increasing number have two so that one fixture can be loaded while the other is in cutting position. This also permits two broaching operations on the same part in the same machine.

Special horizontal broaches were



The hob portion of the leadscrew cuts threads in brass guide fingers in the precision tapping machine. Once cut, the fingers are disengaged and brought into contact with the solid part of the screw for the threading cycle.



A cutter, having a top spiral to give an increasing depth of cut, completes a bevel gear tooth with each revolution. The center of rotation is shifted so the cutter teeth traverse the entire length of the gear.

applied to surfacing auto cylinder blocks before the war, providing ease of chip disposal and requiring little overhead room. Now, however, vertical machines of like size and capacity have been worked out. Larger machines of either type incorporate chip-disposal equipment. Quick-operating clamping fixtures and special tooling have made the process adaptable to relatively small lots of parts and on flat and cylindrical as well as the original irregular work.

More Precise Gear Cutting

War requirements for "zero backlash" fine gears on a production basis resulted in development of a gear shaver capable of removing 0.0002 in. from tooth thickness with a rotary tool. Rack cutters are also used, and the process has replaced "green" grinding on such parts as automotive ring gears. In the latter case, a 15 3/8-in. dia. gear is completed in 20 sec.

A recent gear hobber is designed for climb cutting, and works on an automatic cycle with rapid approach and withdrawal. Setup changes are simplified by using one change gear with the same number of teeth as the piece to be cut, another with a number of teeth equal to thousandths of a inch feed per revolution.

Carbide-tipped hobs and gear-shaper cutters, while costly, have both proved successful. Hobbing machines for carbides have twin worms and wheels driving the table, one handling roughing while the other handles only light finishing to minimize wear.

For mass production of spur or helical gears, a novel machine will cut all teeth at once. The blank is chucked on a horizontal table, while the vertically reciprocating circular cutting head has one tool per tooth. After each stroke, tools are fed in by a cone within the head. Cutter heads are special for each pitch and diameter of gear.

Another new machine, for cutting bevel gears, has a cutter like a circular saw, except that each tooth cuts successively deeper so one tooth is generated per cutter revolution. The cutter revolves continuously on a vertical axis; work is indexed at a gap of several teeth in the cutter. Cutter axis "floats" forward and then back to form tooth ends, so toolbits must be carefully sharpened to preserve form.

Machines for spiral-bevel gears now cut various kinds of toothed couplings and clutches, working opposite sides of two teeth at a time.

Among gear grinders is one which will finish spiral-bevel teeth with a cup wheel, another which will handle spur and helical gears up to 30 in. dia. The latter uses a V-form grinding wheel reciprocating vertically and trued by three diamonds either to true involute or relieved tip form. Internal-gear shavers and lappers have also been developed.

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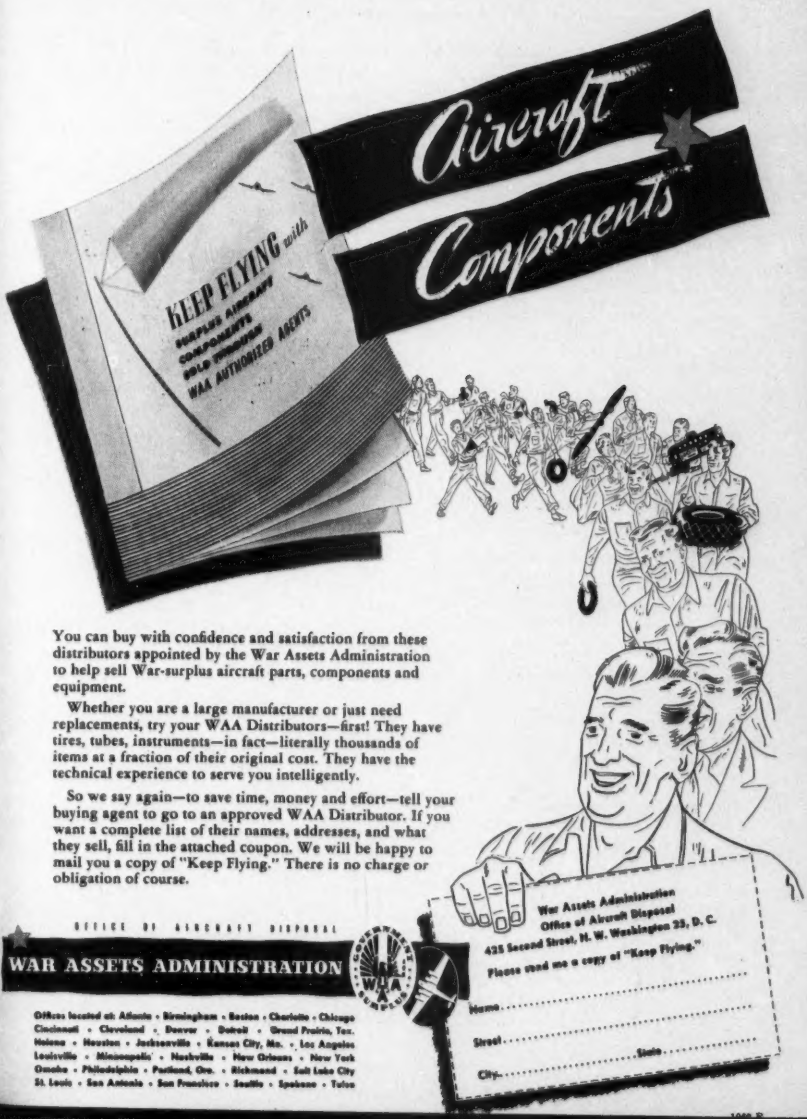

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